United States Court of Appeals

for the

District of Columbia Circuit

TRANSCRIPT OF RECORD

No. 10,873.

JOINT APPENDIX TO BRIEF FOR APPELLANT.

UNITED STATES COURT OF APPEALS

FOR THE DISTRICT OF COLUMBIA CIRCUIT.

NATIONAL LEAD COMPANY, a Corporation,
Appellant,

vs.

JOHN A. MARZALL, Commissioner of Patents,
Appellee.

440

Appeal from the United States District Court for the
District of Columbia.

United States Court of Appeals
for the
District of Columbia Circuit
FILED FEB 26 1951
Joseph W. Stewart
CLERK

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JOINT APPENDIX.

COMPLAINT.

Filed Dec. 1, 1948.

To the Honorable
The Judges of the United States District Court
For the District of Columbia.

Plaintiff for its Complaint alleges:

1. That plaintiff, National Lead Company, a New Jersey corporation, is a citizen of the United States and of the State of New Jersey and resides and has a principal place of business in the City of New York, State of New York.

2. That defendant, Lawrence C. Kingsland, is a citizen of the United States, is Commissioner of Patents of the United States, maintains his official residence within the District of Columbia, and is sued in his capacity as Commissioner of Patents of the United States.

3. That this is an action arising under the patent laws of the United States, to-wit, Section 4915, of the Revised Statutes of the United States (Title 28, Section 63, U. S. Code as amended); that no appeal has been taken to the United States Court of Customs and Patent Appeals, and that there are no adverse or opposing parties.

4. That prior to June 7, 1943, Dee A. Sikes and Jack H. Beesley, citizens of the United States, then residents of Tulsa, Oklahoma, and Carmi, Illinois, respectively, jointly invented certain new and useful improvements in Treatment of Well Drilling Fluids, for which they believed

themselves entitled to Letters Patent of the United States; that said Dee A. Sikes and Jack H. Beesley having complied with the requirements of the Statutes of the United States in such cases made and provided, filed in the United States Patent Office a certain application for Letters Patent of the United States, identified as Serial No. 489,890 on June 7, 1943, the said application containing a written description of said improvements in such full, clear, concise, and exact terms as to enable any person skilled in the art or science to which it appertains to make, construct, compound, and use the same, and said application Serial No. 489,890 particularly pointing out and distinctly claiming the subject-matter upon which they believed themselves entitled to Letters Patent, all of which will fully appear from a duly authenticated copy of said application to be produced in Court.

5. That on May 18, 1943, said Dee A. Sikes and Jack H. Beesley did duly sell, assign and transfer to plaintiff, National Lead Company, its successors and assigns, the full and exclusive right, title and interest in and to said improvements as described and/or claimed in said application Serial No. 489,890, and in and to all Letters Patent and patent rights which may be granted or issued for said improvements; said Assignment being recorded on June 7, 1943 in Liber I-196, page 19, in the United States Patent Office; of such assignment profert is made.

6. That thereafter such proceedings were had that said application was finally rejected by the Patent Office on May 22, 1945, as to all of the claims thereof by the Examiner in charge thereof. That thereafter Plaintiff within six months from May 22, 1945, appealed from said Examiner to the Board of Appeals in the Patent Office, complying in all respects with provisions of the Patent Statutes, R. S. 4909 (Title 35, Section 57, U. S. Code), and the rules in such cases made and provided. That thereafter pursuant

to the rules of the Patent Office said Examiner on May 1, 1946, rendered a written statement purporting to set forth the grounds of his decision and all points involved in the appeal and furnished a copy thereof to Plaintiff. That thereafter the claims on appeal were restricted to claims 3, 4, 5, 8, 15, 16, 21 and 22. That thereafter on June 4, 1948, the Board of Appeals rendered a decision affirming the Primary Examiner and refusing Plaintiff Letters Patent upon the subject-matter described in said application Serial No. 489,890, and particularly pointed out and distinctly claimed in said Claims 3, 4, 5, 8, 15, 16, 21 and 22; all of which will appear from the file of said application Serial No. 489,890 in court to be produced and of which Plaintiff makes profert.

7. That claims 3, 4, 5, 8, 15, 16, 21 and 22 so refused by the Patent Office set forth the disclosure of the subject-matter of Plaintiff's application, Serial No. 489,890, which is in the secret archives in the Patent Office and in accordance with Rule 15 of the Patent Office is and should be preserved in secrecy, and that under Section 4908 of the Revised Statutes (35 U. S. C. 56), Plaintiff can refuse to disclose their subject-matter; said claims are, however, of record in said application, Serial No. 489,890 and the amendments thereto, which will be produced at the trial, and plaintiff makes profert of the same.

8. That in consequence thereof, Defendant has refused and still refuses to grant Letters Patent on said application Serial No. 489,890 as prayed for in said application, on claims 3, 4, 5, 8, 15, 16, 21 and 22, which are germane to the subject-matter now in issue and for which Plaintiff was legally entitled to Letters Patent.

Wherefore, Plaintiff demands judgment against the Defendant, the Commissioner of Patents, ordering and requiring the Defendant to grant unto Plaintiff the Letters Patent prayed for in said Application Serial No. 489,890, on Claims 3, 4, 5, 8, 15, 16, 21 and 22.

National Lead Company,
By John H. Bruninga,
Its Attorney,
1004 Market Street,
St. Louis, Missouri.

St. Louis, Missouri, Dec. 1, 1948.

Richard G. Radue,
Of Counsel,
National Press Building,
Washington, D. C.

ANSWER TO COMPLAINT.

Filed January 8, 1949.

To the Honorable the Judges of the United States District Court for the District of Columbia:

1, 2, 3. Defendant admits the allegations of paragraphs 1, 2 and 3.

4. He admits that on June 7, 1943, Dee A. Sikes and Jack H. Beesley, claiming to have invented jointly certain alleged new and useful improvements in Treatment of Well Drilling Fluids, filed in the Patent Office an application for patent thereon to which Serial No. 489,890 was given. He admits that said application contained a written description of the alleged invention in a form sufficient to comply with the formal requirements of law. He denies for the reasons hereinafter given that plaintiff, National Lead Company, the assignee of said application, is entitled to receive a patent thereon containing any of the claims 3, 4, 5, 8, 15, 16, 21 and 22 thereof.

5, 6. He admits the allegations of paragraphs 5 and 6.

7. He admits that claims 3, 4, 5, 8, 15, 16, 21 and 22 are based on a disclosure made in said application, but denies

that said claims set forth said disclosure. He denies that plaintiff can refuse to disclose the subject matter of said claims in an action under Section 4915, R. S. He admits that plaintiff should produce at the trial a copy of said application, including all proceedings thereon in the Patent Office.

8. He admits that he has refused and still refuses to issue to plaintiff a patent containing any of said claims 3, 4, 5, 8, 15, 16, 21 and 22 therein. He denies that plaintiff is lawfully entitled thereto. He states that said claims are unpatentable in view of the following prior patent and publications, and for the reasons given by the Examiner in his Statement, dated May 1, 1946, and in his Reply, dated May 13, 1947, and by the Board of Appeals in its decision, dated June 4, 1948, copies of which will be furnished at the trial:

Cannon 2,109,858, March 1, 1938.

Stern—Role of Clay and Other Minerals in Oil-Well Drilling Fluids—Report of Investigations No. 3556 of Bureau of Mines—Feb. 1941—pages 76 and 77.

Chemicals by Glyco—page 121—pub. 1944 by Glyco Products Co. of Brooklyn.

The Solvay Blue Book—page 50—pub. 1943 by Solvay Sales Corp. of N. Y.

Profert of copies of the above-cited patent and publications is hereby made.

W. W. Cochran,
Solicitor, U. S. Patent Office,
Attorney for Defendant.

January 7, 1949.

I hereby certify that a copy of this Answer to Complaint was mailed today, January 7th, 1949, to Mr. Richard G. Radue, National Press Building, Washington 4, D. C., attorney for plaintiff.

W. W. Cochran,
Solicitor.

INFORMAL MEMORANDUM.

Filed July 5, 1950.

The claims in suit are all process claims and are unpatentable over the prior art.

The testimony adduced at the trial fails to show clear error on the part of the Patent Office tribunals in refusing to grant any of such claims. Reversal of such holdings is not warranted under the decision in Abbott et al. v. Coe, 71 Apps. D. C. 195.

The solicitor for the United States Patent Office will submit for settlement findings of fact, conclusions of law and a judgment form dismissing the complaint.

F. Dickinson Letts,
Judge.

FINDINGS OF FACT.

(Proposed by Defendant.)

Filed July 18, 1950.

1. The plaintiff, as owner by assignment of the application for patent of Dee A. Sikes and Jack H. Beesley, Serial No. 489,890, seeks, in this action under 35 U. S. C. 63, a decree of this Court authorizing the allowance of claims 3, 4, 5, 8, 15, 16, 21, and 22 of said application.

2. The plaintiff's application in suit relates to the treatment of well drilling fluids and discloses a process of drilling wells by the employment of an aqueous mud-laden drilling fluid, which process comprises adding to such fluid, while maintained at a pH of about 12, sufficient of a starchy colloid to attain and maintain a substantial wall-seal of low water loss, viz., below 5 c. c. (A. P. I.) and at an operable well-drilling viscosity. The application in suit acknowledges as prior art the use of gelatinized or colloidal

starch in a well drilling fluid, and presents, as an improvement thereover, the use of alkali, as caustic soda, to maintain the alkalinity of the drilling fluid at a pH value of about 12. This value of alkalinity has been found to prevent the fermentation of the starch.

3. The patent to Cannon, No. 2,109,858, relates to a drilling fluid for combating heavy shale, and discloses, inter alia, a drilling fluid including starch and caustic soda. Various values are mentioned for the amount of caustic soda, one value being 1%.

4. The publication by Stern, pages 76 and 77 of the Report of Investigations No. 3556 of Bureau of Mines, refers to the use of hydrolyzed starch in well drilling fluid. It states that a pH of about 11 or 12 has been found desirable. This refers to the pH value of the drilling fluid. The starch suspension is prepared with sodium hydroxide.

5. Page 121 of Chemicals by Glyco gives the pH values of enumerated bases, among them being sodium hydroxide.

6. The Solvay Blue Book, page 50, gives curves showing the pH values of solutions of soda products. From the top curve the pH value of a 1% solution of caustic soda is just under 13.0.

7. Plaintiff's testimony shows that a 1% solution of caustic soda will gelatinize or hydrolyze starch.

8. The claims at bar define no invention over the disclosure of the patent to Cannon.

9. The claims at bar define no invention over the disclosure of the publication by Stern.

10. The plaintiff's testimony shows commercial success of the process of the claims in suit.

11. The claims in suit are all process claims and are unpatentable over the prior art.

INFORMAL MEMORANDUM.

Filed July 5, 1950.

The claims in suit are all process claims and are unpatentable over the prior art.

The testimony adduced at the trial fails to show clear error on the part of the Patent Office tribunals in refusing to grant any of such claims. Reversal of such holdings is not warranted under the decision in Abbott et al. v. Coe, 71 Apps. D. C. 195.

The solicitor for the United States Patent Office will submit for settlement findings of fact, conclusions of law and a judgment form dismissing the complaint.

F. Dickinson Letts,
Judge.

FINDINGS OF FACT.

(Proposed by Defendant.)

Filed July 18, 1950.

1. The plaintiff, as owner by assignment of the application for patent of Dee A. Sikes and Jack H. Beesley, Serial No. 489,890, seeks, in this action under 35 U. S. C. 63, a decree of this Court authorizing the allowance of claims 3, 4, 5, 8, 15, 16, 21, and 22 of said application.

2. The plaintiff's application in suit relates to the treatment of well drilling fluids and discloses a process of drilling wells by the employment of an aqueous mud-laden drilling fluid, which process comprises adding to such fluid, while maintained at a pH of about 12, sufficient of a starchy colloid to attain and maintain a substantial wall-seal of low water loss, viz., below 5 c. c. (A. P. I.) and at an operable well-drilling viscosity. The application in suit acknowledges as prior art the use of gelatinized or colloidal

starch in a well drilling fluid, and presents, as an improvement thereover, the use of alkali, as caustic soda, to maintain the alkalinity of the drilling fluid at a pH value of about 12. This value of alkalinity has been found to prevent the fermentation of the starch.

3. The patent to Cannon, No. 2,109,858, relates to a drilling fluid for combating heavy shale, and discloses, inter alia, a drilling fluid including starch and caustic soda. Various values are mentioned for the amount of caustic soda, one value being 1%.

4. The publication by Stern, pages 76 and 77 of the Report of Investigations No. 3556 of Bureau of Mines, refers to the use of hydrolyzed starch in well drilling fluid. It states that a pH of about 11 or 12 has been found desirable. This refers to the pH value of the drilling fluid. The starch suspension is prepared with sodium hydroxide.

5. Page 121 of Chemicals by Glyco gives the pH values of enumerated bases, among them being sodium hydroxide.

6. The Solvay Blue Book, page 50, gives curves showing the pH values of solutions of soda products. From the top curve the pH value of a 1% solution of caustic soda is just under 13.0.

7. Plaintiff's testimony shows that a 1% solution of caustic soda will gelatinize or hydrolyze starch.

8. The claims at bar define no invention over the disclosure of the patent to Cannon.

9. The claims at bar define no invention over the disclosure of the publication by Stern.

10. The plaintiff's testimony shows commercial success of the process of the claims in suit.

11. The claims in suit are all process claims and are unpatentable over the prior art.

12. The testimony adduced at the trial fails to show clear error on the part of the Patent Office tribunals in refusing to grant any of the claims at bar.

CONCLUSIONS OF LAW.

1. The discovery of a hitherto unstated property of a well drilling fluid containing starchy colloid and sufficient caustic soda to make the pH value about 12 is not such a discovery as entitles plaintiff to a patent therefor.

2. In the absence of a showing of clear error on the part of the Patent Office tribunals in refusing to grant any of the claims at bar, reversal of such holdings is not warranted.

3. The plaintiff is not entitled to a patent containing any of the claims in suit.

4. The complaint should be dismissed as to all the claims at bar.

F. Dickinson Letts,
Judge.

PLAINTIFF'S PROPOSED FINDINGS OF FACT.

Filed July 19, 1950.

1. The plaintiff, as owner by assignment of the application for patent of Dee A. Sikes and Jack H. Beesley, Serial No. 489,890, seeks, in this action under 35 U. S. C. 63, a decree of this Court authorizing the allowance of claims 3, 4, 5, 8, 15, 16, 21 and 22 of said application.

2. The plaintiff's application in suit relates to the treatment of well drilling fluids and discloses and claims generally a process of drilling wells by the employment of an aqueous mud-laden drilling fluid, which process comprises bringing such a fluid to a pH of about 12, adding a starchy colloid to said fluid in an amount sufficient to attain a substantial wall-seal of low water-loss, viz., below 5 c. c.

(A. P. I) and at an operable well-drilling viscosity, and thereafter adding an alkali and a starchy colloid, when required, in amounts sufficient to maintain said pH and said water loss. A starchy colloid is gelatinized or hydrolyzed starch. The pH of about 12 is specified as between a minimum of 11.7 and a maximum of 13.3. The application also discloses and claims such process as applied to cement-contaminated drilling fluids. An operable well-drilling viscosity is one in which the fluid can be readily pumped and will entrain in the well but still deposit its cuttings outside of the well.

2a. The application in suit acknowledges as prior art starch gelatinization by caustic soda and the use of a starchy colloid, i. e., gelatinized starch, in an aqueous well drilling fluid; that starch ferments in fresh water drilling fluids but not in concentrated salt water; and that fermentation increases the water loss. The application presents, as an improvement over the prior art, the above-described process of preventing fermentation of gelatinized starch in an aqueous mud-laden drilling fluid by first bringing the alkalinity of the drilling fluid to a pH value of about 12, by the use of an alkali such as caustic soda or hydrated lime, with sufficient gelatinized starch added to attain a water loss below 5 c. c., and thereafter adding more alkali and gelatinized starch to maintain that pH and water loss, but all the time at an operable well drilling viscosity. The above-described process has been found in practice to prevent the fermentation of the gelatinized starch in a drilling fluid in which the aqueous phase is either fresh or salt water, and to attain and maintain a low water loss, all at an operable well drilling viscosity. In order to prevent fermentation, the pH of 12 must be maintained during the course of drilling.

3. The patent to Cannon, No. 2,109,858, issued March 1, 1938, relates to a drilling fluid for combating heaving shale and discloses and claims drilling fluids comprising caustic

soda and bentonite, together with an organic compound such as tannic acid or humic acid or gallic acid or sugar or starch. The caustic soda is specified as at least ⅓ of 1% to a maximum of 7%, with examples of 1%, 2% and 7%, as related to the drilling fluid. The bentonite is specified as 10%, 20% and 30% as related to the drilling fluid. No percentages are specified for any of the organic compounds except for quebracho extract, a crude tannic acid, where the percentages are from 1% to 2% as related to the drilling fluid.

3a. Quebracho extract per se is soluble in water; when reacted with caustic soda it is still soluble in water. Together they have been used since 1930 to reduce the plasticity or viscosity of drilling fluids. Starch as such is inert and not soluble in water; when reacted with caustic soda it is converted to gelatinized starch, provided from 0.55 to 0.60% of caustic soda is used; ⅓ of 1% is not sufficient to gelatinize starch; when 7% caustic soda is used the starch will carmelize and will become ineffective to decrease the water loss. Hydrated lime will not gelatinize starch.

3b. When caustic and quebracho are used with bentonite in accordance with the disclosure in the Cannon patent, the resultant fluid will be at an operable and usuable well-drilling plasticity or viscosity for a drilling fluid; in fact, there will be a decrease in plasticity or viscosity as compared to when caustic and quebracho are not used. When caustic and starch are used with bentonite in accordance with the disclosure in the Cannon patent, by substituting starch for quebracho, the resultant fluid will not be at an operable or usable well-drilling plasticity or viscosity for a drilling fluid, but the result will be practically a solid; in fact there is an increase of the plasticity or viscosity as compared to when caustic and starch are not used.

4. The publication by Stern, pages 76 and 77 of the Report of Investigations No. 3556 of Bureau of Mines, published February, 1941, describes the state of well drilling

fluids as it then existed, including the patent to Cannon, No. 2,109,858 and a communication from George E. Cannon, the applicant of that patent, both of which are cited and discussed by Stern. Stern specifically states in February, 1941, that at that time only recently had starch found application in drilling mud fluids as a result of the development that hydrolyzed (gelatinized) starch imparted a good filter test (water loss) to salt water mud (drilling fluid).

4a. Stern describes the making of hydrolyzed (gelatinized) starch by a 10 to 1 ratio of starch to sodium hydroxide (caustic soda). Stern states that starch tends to ferment unless a preservative is added; but he only mentions as preservatives salt and an alcohol. Stern in 1941 did not disclose to those skilled in this art, maintaining a drilling fluid at a pH of about 12 in connection with hydrolyzed (gelatinized) starch, or that the maintenance of that pH will prevent fermentation of such a starch; or that a low water loss, viz., 5 c. c., will be attained. Stern described the then generally known method of gelatinizing starch by a 10 to 1 ratio of starch to caustic soda. When the resultant starch caustic soda in water mixture described by Stern is added to a drilling fluid, whether a salt water or a fresh water fluid, a pH of 12 is not attained or maintained, but a pH of from 8.5 to 10.9, neither of which will prevent fermentation.

Respectfully submitted,

Bruninga and Sutherland,
By John H. Bruninga,
Attorneys for National Lead
Company.

St. Louis, Missouri,
July 12, 1950.

JUDGMENT.

Filed July 18, 1950.

This action came on to be heard at this term and thereupon, upon consideration thereof, it is this 18th day of July, 1950,

Adjudged that the complaint be and it is hereby dismissed, with costs against the plaintiff.

F. Dickinson Letts,
Judge.

PLAINTIFF'S MOTION FOR A NEW TRIAL.

Filed July 27, 1950.

Now comes Plaintiff in the above-entitled cause and respectfully moves this Court for a new trial under Civil Rule 59, to open the judgment heretofore entered, take additional testimony, amend findings of fact and conclusions of law or make new findings and conclusions, and direct the entry of a new judgment in favor of Plaintiff.

We do not here want to burden this Court with a restatement of the facts in this case, nor with an extended discussion of the law applicable to this case; for they have been discussed in Plaintiff's Brief, filed after the trial and before this Court's Memorandum. Nor do we believe it is necessary to take additional testimony unless this Court so desires, although it will be taken if this Court so desires, even though Civil Rule 59 provides for that and has therefore been included in the above statement. We simply want to direct this Court to the following:

Plaintiff's Proposed Findings of Fact, dated July 12, 1950, set forth briefly the salient facts, about which there can be no dispute. The Commissioner's Solicitor's proposed finding 10 also concedes that there has been commercial success of the process of the claims in suit, although that expresses it rather mildly, because the success has been outstanding, beginning with the year after the filing of the application in suit.

Plaintiff's application does not claim an all-inclusive process, but the claims are extremely modest, of which claim 8 is complete even as to details.* We want to quote that claim 8, which we want to parse into its component parts as follows:

> **Claim 8.** In the art of drilling wells by the employment of an aqueous mud-laden drilling fluid, the process comprising,
>
> > (a) bringing such a fluid to a pH of about 12,
> >
> > (b) adding a starchy colloid to said fluid in an amount sufficient
> >
> > > (x) to attain a substantial wall-seal of low-water-loss, viz., below 5 c. c. (A. P. I.),
> > >
> > > (y) and at an operable well-drilling viscosity,
> >
> > (c) and thereafter adding an alkali and a starchy colloid, when required,
> >
> > > (z) in amounts sufficient to maintain said pH and said water loss.

The Patent Office does not question but that the subject-matter of that claim was disclosed in Plaintiff's application as filed, as contrasted with Abbott et al. v. Coe, 71 App. D. C. 195, 109 F. (2d) 449, 450, 451. What the Patent Office contends is that the subject-matter was disclosed in the Stern publication of 1941 and in the Cannon patent 2,109,-

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* That claim as finally amended is set forth in the Examiner's supplemental statement dated August 23, 1946, filed as an appendix to Plaintiff's Brief because the Examiner's Statement of May 1, 1946, Defs. Ex. F, does not quote the finally amended claims in issue and before the Board of Appeals and this Court.

858 of 1938, or perhaps by a combination of the two. An examination of the claim just quoted with reference to that publication and that patent will show that such is not the fact.

Let us assume that both Stern and Cannon disclose the introductory part of the claim, and consider next the first phrase.

(a) **bringing such a fluid to a pH of about 12,**

That means a pH between a minimum of 11.7 and a maximum of 13.3.

The Stern publication does not disclose that the drilling fluid itself, to which the starchy colloid (gelatinized or hydrolyzed starch) is added, is even brought to a pH of 11 or 12; because the statement "A pH of about 11 or 12 has been found desirable" is at the end of the same paragraph where Stern describes the then well-known method of gelatinizing starch. It is not until the next paragraph that Stern describes the addition of gelatinized starch to a drilling fluid, and there it is added to one containing salt so as to prevent the drilling fluid from fermenting, or containing alcohol as a preservative.

Larsen showed in his deposition that if Stern's gelatinized starch is added to a drilling fluid, whether a fresh water drilling fluid or a salt water drilling fluid, the resulting pH will be from 8.5 to 10.9, neither of which will prevent fermentation of gelatinized starch; and the Patent Office has not disputed that testimony.

Cannon does not say anything about bringing a drilling fluid to a pH of about 12, that is, between a minimum of 11.7 and a maximum of 13.3. The Patent Office has simply figured out that with 1% caustic soda added, the pH will be within those limits. However, the testimony of Larsen and of Farnham at the trial shows that with 7% caustic, recommended by Cannon, the pH will be so much above 13.3 as to result in caramelization of the starch; and that testimony was not disputed by the Patent Office.

In other words, anyone following Cannon would get into trouble, as distinguished from the precautions in the application in suit of not running the pH over 13.3.

(b) **adding a starchy colloid to said fluid in an amount sufficient**

(x) **to attain a substantial wall-seal of low water-loss, viz., below 5 c. c. (A. P. I.),**

(y) **and at an operable well-drilling viscosity.**

Stern adds gelatinized starch to a drilling fluid, and we can assume for the moment that he attains a water-loss reduction, although he does not disclose that the process described by him will result in a water-loss below 5 c. c., which is extremely important; and he does not disclose the addition of such a starchy colloid in any amount to a drilling fluid brought to a pH of about 12, and all at an operable well-drilling viscosity.

Cannon does not disclose the addition of gelatinized starch to a drilling fluid at all. What he discloses is the addition of starch (not gelatinized starch), and the amount of starch added is not disclosed. We showed experimentally before this Court, and Larsen showed by actual demonstration in his deposition, that when quebracho is used with caustic soda in the manner disclosed by Cannon, the drilling fluid will be at an operable well-drilling viscosity, in fact, its viscosity will have been reduced; however that when starch is substituted for quebracho in the Cannon patent disclosure, the resultant drilling fluid is not at an operable well-drilling viscosity, but at an unusable one, in fact, it is practically a solid, and the viscosity is increased rather than decreased, the very opposite of what takes place when quebracho and caustic soda are used.

We are not attacking the operativeness of the Cannon patent disclosure when confined to its proper scope, namely, the use of quebracho with caustic soda; but the attempt of the Patent Office to substitute starch for quebracho shows that two things which are not equals, namely, quebracho plus caustic soda on the one hand and starch plus caustic soda on the other hand, cannot be interchanged.

(c) **and thereafter adding an alkali and a starchy colloid, when required,**

> (z) **in amounts sufficient to maintain said pH and said water loss.**

Stern discloses the preventing of fermentation by using a salt water drilling fluid, or by the use of alcohol; Stern certainly does not even mention the addition of alkali in addition to gelatinized starch in an amount sufficient to maintain the pH as well as the water loss.

Cannon does add an alkali, namely, caustic soda, but that is in connection with quebracho, to reduce the plasticity or viscosity of the drilling fluid, as it indeed does. While Cannon of course mentions starch, as we have shown, if caustic soda is used at either the lower limit of one-third of 1%, or the upper limit of 7%, the result will be at the lower limit no gelatinization of the starch, and at the upper limit caramelization of the starch.

An attempted combination of Stern plus Cannon will lead nowhere. Stern specifically discloses preventing of fermentation of gelatinized starch by salt, and by an alcohol. On the other hand, Cannon does not add gelatinized starch to a drilling fluid at all but adds starch, and if starch is added to a drilling fluid already containing caustic soda and bentonite, then, while the starch may possibly become gelatinized, the result will be something unusable. The combination of two unequal things will never make any sense in patent law.

We fully recognize the authority of Abbott et al. v. Coe, 71 App. D. C. 195, 109 F. (2d) 449. We have called attention to the fact that the result claimed in that case was not even mentioned in the application as filed, while such is not the case here.

We do not dispute that the question before this Court of whether or not there was invention, is whether the finding of the Patent Office that there was none is consistent with the evidence. Nor do we dispute that more than a mere preponderance of evidence is necessary to justify a reversal of the Patent Office in deciding that Plaintiff is entitled to a patent. In this case however the undisputed testimony establishes that first, neither the Stern publication nor the Cannon patent disclosed the process described and claimed in the application in suit; and second, that no possible combination of the two discloses it.

The question of invention is a question of fact and surely, with from three to five years intervening between the Stern publication and the Cannon patent, and the application in suit, in this rapidly moving well-drilling art, the immediate acceptance of the process by the public after its introduction should certainly swing the balance in favor of patentability of the process.

The most that can be said of the Cannon patent is that following it, by many trials somewhere between the maximum and minimum limits, a pH of about 12, that is, between a minimum of 11.7 and a maximum of 13.3, might be attained. However that simply involves the well-known principle established by the Supreme Court and applied in Abbott v. Coe, 109 F. (2d) 449, 451, namely that

> "Accidental results, not intended and not appreciated, do not constitute anticipation."

Moreover, as we showed, when starch be substituted for quebracho in the Cannon patent disclosure, the result will be something unusable, namely practically a solid, and not a drilling fluid at an operable well-drilling viscosity, which is specifically recited in the claims in suit.

The Stern publication disclosure requires the conversion of something appearing at the end of the paragraph, describing the gelatinization of starch by the usual 10-to-1 starch-caustic mixture, namely "a pH of about 11 or 12 has been found desirable," into something entirely different, namely, that the pH is that of the drilling fluid to which the gelatinized starch is added. And that in spite of the fact that the only place where Stern talks about the addition of gelatinized starch to a drilling fluid, is in the next paragraph, namely, addition to a drilling fluid containing salt or containing an alcohol to prevent fermentation.

The characteristics of a patentable process was specifically stated by the Court of Appeals for this Circuit in Kelley v. Coe, 99 F. (2d) 435, 441, footnote, as follows:

> "A process is a mode, method, or operation, whereby a result or effect is produced. Corning v. Burden, 15 How. 252, 14 L. Ed. 683. 'A patentable process is a method of treatment of certain materials to produce a particular result or product.' Holland Furniture Co. v. Perkins Glue Co., 277 U. S. 245, 255, 48 S. Ct. 474, 478, 72 L. Ed. 868."

Here, neither the Cannon patent nor the Stern publication disclose either the mode, method or operation described in the claims in suit, nor the result or effect produced. The Court says, p. 441:

> "And in none of the references is there taught, nor do all of them together reveal, the necessity for coordination of the various steps in harmonious interaction as shown by Kelley. As was explained by wit-

> ness Drinker: 'It has to be a coordinated whole. You can divide it up theoretically into parts, but in actual operation you cannot distinguish them for they are coordinated as one unit when it is done.' Kelley was the first to conceive the idea and to describe the method for putting the elements together into a unit which functioned successfully."

Neither Stern nor Cannon reveal the necessity for coordination of the various steps in harmonious interaction as set forth in the claims in suit. Sikes and Beasley were the first to conceive the idea and to describe the method of putting the steps together into a unit to function successfully.

The Court further says, p. 441:

> "In order that a reference or group of references may teach a process, the process must be deliberate and the means understood."

It is apparent that neither Stern nor Cannon deliberately disclosed any process or anything else in which any steps were taken or the means understood to bring a drilling fluid to a pH of about 12 in coordination with the addition of a starchy colloid, added in an amount sufficient to secure a water loss of 5 c. c., and thereafter adding alkali and starchy colloid in an amount sufficient to maintain that pH and water loss, all at an operable well-drilling viscosity. Neither one had anything like that in mind. Neither one of them disclosed anything of the kind to anyone skilled in the art for the three to five years intervening between Stern and Cannon and the application in suit. Stern simply disclosed the gelatinization of starch in accordance with the generally known ratio of 10-to-1 of starch to caustic soda, and the addition of that gelatinized starch to a salt water drilling fluid or to one containing an alcohol. Cannon does not even disclose the addition of gelatinized starch to any drilling fluid, and if the Cannon process of gelatinizing the starch in the drilling fluid itself be followed by substituting starch for quebracho, the result will be something unusable.

This case is somewhat like Hayward v. Coe, Civil Action No. 20,980, decided by Justice Bailey in 1944, and in which Plaintiff's Attorney was attorney for Hayward; and we file herewith photostats of three opinions by Justice Bailey, together with his Findings of Fact, Conclusions of Law and the Judgment. The situation in that case can be briefly stated as follows:

The case involved a method or process of detecting gas dilutedly occluded in a mud-laden drilling fluid, specifically by means of what is known as a hot wire gas detector, which is simply a wire whose electrical resistance changes when contacted by gas. A Chalkley patent relied on by the Patent Office allegedly disclosed such a process, but instead of a hot wire detector he employed an explosion chamber to which the gas passed, and the presence of the gas was determined by a thermo-couple, which is simply an electrical thermometer. The Patent Office therefore took the position that the case simply involved a substitution of a hot wire gas detector for a thermo-couple.

At the trial it was shown that the gas encountered in drilling fluids reaching the surface from below the earth, was exceedingly small, on the order of a fraction of 1%. Also that in order for an explosion chamber to be effective for measurement of gas and determination of an actual explosion by a thermo-couple, the percentage of gas had to be on the order of between 5% and 12%. In other words, it was shown that Chalkley's process was impractical for the detection of the exceedingly small percentage of gas encountered in drilling fluids.

Justice Bailey first held that the question of the inoperativeness of the Chalkley patent could not be raised, because it was not raised in the Patent Office. Even after it was shown that that question could not have been raised, Justice Bailey adhered to his first decision. However, on filing of a second motion for a new trial, he held the subject-matter patentable, and accordingly adjudged that a patent should issue.

The case is rather analogous to this case, particularly if we consider the Cannon patent, where the substitution of starch for quebracho in Cannon's disclosure would result in an unusable drilling fluid. While Justice Bailey stresses the fact that Hayward was able to obtain quantitative analysis, that is analogous to the situation we have here where the claims specify maintaining a water loss of below 5 c. c. Moreover, in this case we do not argue that the Cannon patent disclosure is inoperative when confined to its proper scope, namely the employment of caustic and quebracho, but only that when, as attempted by the Patent Office, starch be substituted for quebracho, the result will be something unusable.

This is simply the ordinary case where at the trial evidence is produced to make out a case. The undisputed evidence in this case is such as clearly to show that the Patent Office was in error in refusing to grant a patent on the extremely modest claims before this Court. It is therefore respectfully requested that Plaintiff's motion be granted.

Respectfully submitted,

JOHN H. BRUNINGA,
Attorney for Plaintiff National
Lead Company.

St. Louis, Missouri.
July 24, 1950.

ORDER OVERRULING MOTION FOR NEW TRIAL.

Filed Sept. 12, 1950.

NOTICE OF APPEAL TO THE UNITED STATES COURT OF APPEALS FOR THE DISTRICT OF COLUMBIA.

Filed October 11, 1950.

Notice is hereby given that National Lead Company, plaintiff above-named, hereby appeals to the United States Court of Appeals for the District of Columbia from the final judgment entered in this action on July 18, 1950, and from the order of the Court overruling plaintiff's timely motion for a new trial entered September 12, 1950.

Respectfully submitted,

John H. Bruninga,
Attorney for Appellant National
Lead Company,
1004 Market Street,
St. Louis 1, Missouri.

St. Louis, Missouri,
October 9, 1950.

DOCKET ENTRIES.

Complaint Civil Action No. 4867-48, filed December 1, 1948.

Answer to complaint, filed January 8, 1949.

Order to change name of defendant Kingsland to Marzall, filed December 7, 1949.

Trial—Began June 22, 1950, and concluded on June 23, 1950.

Informal memorandum of Judge Letts, filed July 5, 1950.

Findings of fact and conclusions of law (proposed by defendant), filed July 18, 1950.

Judgment, filed July 18, 1950.

Letter to Judge Letts from J. H. Bruninga, filed July 19, 1950.

Plaintiff's proposed findings of fact and conclusions of law, filed July 19, 1950.

Plaintiff's motion for a new trial, filed July 27, 1950.

Order overruling motion for new trial, filed September 12, 1950.

Notice of appeal to the U. S. Court of Appeals for the District of Columbia Circuit, filed October 11, 1950.

Order allowing cash deposit in lieu of bond, filed October 11, 1950.

Order extending time for filing and docketing of record, filed November 20, 1950.

Praecipe, filed November 20, 1950.

Order permitting use of original copies of depositions, filed December 15, 1950.

Order—Clerk of District Court for D. C., to transmit original copies to Court of Appeals, filed December 22, 1950.

PRAECIPE.

Filed November 20, 1950.

Will you please incorporate in the transcript of record on appeal to the United States Court of Appeals for the District of Columbia Circuit, in the above-entitled case, the following:

(1) Complaint.

(2) Answer.

(3) The reporter's transcript of evidence.

(4) The following documentary exhibits:

(a) Plaintiff's Exhibits 1, 1A, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14 and 15.

(b) Defendant's Exhibits A, B, C, D, E and H.

(5) Depositions of Jack H. Beesley and Delmar H. Larsen.

(6) Memorandum Opinion of District Court.

(7) Plaintiff's Proposed Findings of Fact.

(8) Findings of Fact and Conclusions of Law.

(9) Judgment.

(10) Plaintiff's Motion for New Trial.

(11) Order Overruling Motion for New Trial.

(12) Notice of Appeal.

(13) Order of the District Court permitting a cash deposit in lieu of bond.

(14) All docket entries.

(15) This Praecipe.

Tr. 1

REPORTER'S TRANSCRIPT OF PROCEEDINGS AT TRIAL.

Washington, D. C., June 22, 1950.

The above-entitled matter came on for trial before the Hon. F. Dickinson Letts, Associate Judge, at 10 o'clock a. m.

Appearances:

On behalf of the Plaintiff:
John H. Bruninga, Esq.
On behalf of the Defendant:
H. S. Miller, Esq.

Tr. 2 Plaintiff's Opening Statement by John H. Bruninga.

Defendant's Opening Statement by H. S. Miller.

* * * * * * *

Tr. 29

HAROLD H. FARNUM

was called as a witness by the plaintiff and, being first duly sworn, was examined and testified as follows:

Direct Examination,

By Mr. Bruninga:

Q. What is your name, and where do you live? A. Harold H. Farnum, Houston, Texas.

Q. What is your business? A. Assistant to the general manager, Baroid Sales Division, National Lead Company. The Baroid Company is engaged in manufacturing, selling and servicing materials that are used in the preparation of oil and drilling wells.

Q. Give briefly your education. A. I graduated in 1924 from the California Institute of Technology, with Tr. 30 a degree of Bachelor of Science in Chemical Engineering.

Q. What did you do after that? A. I worked for five years for the General Petroleum Corporation of California as research chemist, and later as foreman and as engineer in their natural gas department, and beginning in 1929 I was employed by the company that later became Baroid Sales Division. I have worked there as research chemist, as division manager in charge of sales, service engineer and later as a director of research, and after that in charge of several other technical departments.

Q. How early did you become acquainted with oil well drilling? A. Intimately connected with it in 1929.

Q. By what system? A. Pardon?

Q. By what system? A. The rotary drilling.

Q. Now, refer to the paper marked PX-2 and just give very, very briefly the outline of that and we will have it in the record. A. This is a sketch of a rig used in the rotary method of drilling an oil well.

The drilling bit is shown on the extreme right at the bottom. It is driven by the rotary table which is on the floor of the derrick in the central part of the sketch.

Tr. 31 The connection between the rotary table and the bit is by the drill pipe, which is a series of 90-foot joints screwed together and hollowed.

The drilling is done by rotating the rotary table. The bit disengages parts of the earth and it is flushed to the surface by the drilling mud or drilling fluid, which is picked up by the mud pumps, shown on the lower left part of the sketch.

The mud is circulated through the rotary hose and down the drill stem, and emerges through holes in the bit. It then raises to the surface of the earth in the annular space between the drill pipe and the hole that has been bored.

After it rises to the surface, the cuttings are removed, either by settling in the mud ditch, or by screening out through the vibrating screen. The mud is again circulated.

Q. What kind of drilling fluids were used when you started in in 1929? A. They were water base in which clays were suspended and weighting materials such as barytes or iron oxide was incorporated in it.

Q. What was the consistency of that drilling fluid at that time? A. It was considerably more viscous than the muds later used.

Tr. 32 Q. Do you know what bentonite is? A. Yes

Q. What, really, is bentonite? A. Bentonite is a highly colloidal clay found in the Black Hills area of this country and a few other places. It forms a suspension in water at relatively low concentrations, on the order of three to five percent by weight, where ordinary clays will require 20 to 30 percent by weight to produce the same consistency of suspension.

Q. How long has your company been selling bentonite, if at all? A. Over 21 years.

Q. Under what name? A. The trade name Aquagel.

Q. You talk about weighting material. What is that? Is it sold by your company, and if so, by what name? A. Weighting material is an inert high specific gravity solid such as barytes or iron oxide, and it is added to the drilling mud to increase its density.

Q. You might tell me this. Is the viscosity of drilling fluid as used in rotary drilling critical or not? A. It is very critical. If it is too low, it won't have enough transporting power to bring the cuttings up from the face of the bit. If it doesn't have what we refer to as gel strength, any cuttings that are part way up the hole when mud circulation is suspended will fall to the bot-
Tr. 33 tom of the hole. Sometimes if the viscosity is
too high it will cause improper operation of the mud pumps to overcome the friction of the mud, and it will also entrap gas in the mud, and thereby endanger the well of blowing out.

Q. What about dropping out cuttings if the viscosity is too high? A. Also, if the viscosity is too high, that would interfere with the deposition of the cuttings in the mud ditch. Also, it would cause the mud to carry over the end of the vibrating screen before all the cuttings were taken out there.

Q. If the drilling fluid is too thin, what do you add? A. Add a colloidal clay, such as bentonite.

Q. How about an ordinary clay, ordinary good drilling clay? A. Sometimes that is added.

Q. Now, if the drilling fluid is too thick, what do you do then? A. Treat it with a mud thinning chemical, such as caustic and quebracho, or polyphosphates.

Q. What is quebracho? A. That is crude tannic acid.

Q. What happens when you mix it with caustic soda? A. It forms a solution.

Q. Does quebracho form a solution in water? Tr. 34 A. Yes, it does.

Q. Does caustic and quebracho form a solution in water? A. Yes.

Q. Then are caustic and quebracho used as mud thinners? A. Yes, that is one of the most common of the mud thinners.

Q. How far back does that go, do you know? A. I first saw it in 1930 or 1931.

Q. Now, you might tell the Court about the amount of mud that is kept in a mud pit at a well, in barrels. A. That depends on the size of the hole that is to be drilled. Usual practice would be to have a surface pit containing from 1,000 to 2,000 barrels of the mud. The volume of the mud that would be in the hole will increase as the depth of the hole increases, but in an 8,000-foot hole, average diameter, you would expect another five to eight hundred barrels. Of course you would have a small amount of mud in the hole and a small amount in the reserve pit, or circulating pit.

Q. To make this mud that you have, this drilling mud or drilling fluid, is it today wholly handled by what we used to call roughnecks in the old days? A. No. Tr. 35 The handling of drilling mud now is a highly specialized science.

Q. Do they have scientists? A. Yes. Almost all of the oil companies and many of the contractors employ petroleum engineers or chemical engineers to look after the condition of the mud, almost continually.

Q. Does your company sell quaebracho and phosphates? A. Yes, we do.

Q. Do you sell direct to the consumers or whom do you sell to? A. Our sales are made through dealers that in turn sell to the consumers.

Q. Do you give any service at all, your company? A. Yes, we employ about 150 service engineers that are scattered throughout the oil fields of the United States, and they offer free service to the drilling contractors or oil companies wherever mud problems exist.

Q. In finding out viscosity, is that guessed at, like it used to be in the old days, by your finger? A. No, the viscosity is measured very accurately, either by use of a funnel that is built to rigid specifications, by means of density, the time required for a certain amount of mud to discharge from the funnel, or you measure it by a laboratory instrument known as a Stormer viscosimeter.

Tr. 36 Q. How is the weight determined? A. Most of the people determine the weight by a balance, which is balanced on a knife edge. One end has a cup of very accurate dimensions, and the other is the usual arm on which the slider is posed until the cup on one side and the weight and arm on the other balance.

Q. At what viscosity should the drilling fluid be maintained in order to be good drilling fluid? A. Under normal conditions the viscosity will vary between perhaps 10 centipoises and 50 centipoises.

Q. That is Stormer? A. That is Stormer.

Q. What does that correspond to in Marsh's funnel? A. In terms of seconds in the Marsh funnel, that would be on the order of 35 seconds to 60 or 70 seconds.

Q. This viscosity, can you give the Court an idea what it corresponds to in normal drilling fluid that should be used? A. A clear water drilling mud of 15 centipoises would be about the same consistency as a heavy motor oil at 75 or 80 Fahrenheit.

Q. Suppose drilling is interrupted. What happens to the cuttings unless precautions are taken? If you just had water, what would happen? A. If there was Tr. 37 just water, or a mud that has no ability to gel, all the cuttings that were suspended in the mud between the face of the bit and the surface of the earth would begin to settle down. If you couldn't pull out the drill pipe, they would settle tightly around the bit and the drill pipe, and they would be frozen in the hole.

Q. Is anything done to take care of that in the makeup of a drilling fluid? A. Yes. Collodial clays and mud thinning chemicals are added to the drilling mud in such quantities as to control this characteristic. We attempt to arrive at the gel strength which is in rather narrow limits.

Q. Suppose you have got your 2,000 barrels of drilling mud all made up, and you start to drill. What happens during the course of drilling through that fluid that comes out of the hole? I mean is anything added to it at all? A. The drilling mud is constantly changing in composition, first because of the cuttings that are incorporated in the mud, not all of them being settled out or screened out. Some of the cuttings there form rather colloidal gells that are incorporated in the mud. Also, ground water will seep into your drilling mud from the exposed surface of the bore hole. To offset that, the drilling mud engineer will add water or weighting material or clays, or treating chemicals at the surface, and more or less continually.

Q. The drilling fluid must be maintained in con- Tr. 38 dition during the course of drilling, is that right? A. That is right.

Q. What other function than carrying the cuttings out of the well does the drilling fluid perform? A. At all times it must have enough density in weight per unit so that the hydrostatic head it imposes against any part of the open hole is greater than the formation pressure. Otherwise the fluids that are in the porous strata of the formation will blow into the hole and in turn blow out at the surface.

Q. In what way does the drilling fluid act to prevent that outside of its hydrostatic head? A. The fact that it has a hydrostatic head greater than the formation pressure would tend to cause the flow of the mud from the bore hole into the formation. That is stopped by having the right kind of solids in the mud, the proper amount of clay colloid or other type of emulsoid colloid will cause the deposit of a thin filter character at the surface of the bore hole opposite that porous formation.

Q. Suppose you reach a producing formation of oil or gas? What happens then, when you take all those precautions? A. There will be a flow of water filtered from the mud into the producing horizon. That must be kept at a minimum, otherwise the water will force the oil and gas back so far that it can never be produced, or
Tr. 39 it will greatly reduce the rate of production, so
we choose there to add increased quantities of gel forming colloids to the mud, and thereby reduce the amount of water that will go into the producing formation.

Q. That water that goes into the producing formation is called something. A. The water that is lost into the formation?

Q. Yes. A. It is filtrate from the drilling mud.

Q. But it is called water loss? A. Yes. In our filter pipe test to evaluate that, we refer to that as water loss, or filter loss.

Q. You can determine what the water loss of a certain drilling fluid will be when put in a well? You can do that above ground? A. That is right. We have a special filter press for doing that.

Q. Is that a standard thing today? A. Yes, that is standard, and has been adopted for several years by the American Petroleum Institute.

Q. Tell us just very, very briefly how you do that. A. Yes. It is a filter press three inches in diameter and about five or six inches high. It can be broken down to its integral parts quickly. The filter area is a filter press backed up by screens and the filter pressure is supplied
Tr. 40 by air pressure. The mud is placed in the filter for 30 minutes. The reading is taken and reported in cc's, as so many cc's filter loss, API test.

Q. Cc meaning cubic centimeter? A. Yes, sir.

Q. Eighty cc makes a filter loss of 80? A. That is right.

Q. That is standard, is that right? A. For the filter press test I have just described, which has been adopted for several years by the American Petroleum Institute.

Q. What kind of water loss will ordinary clays give in fresh water? A. Ordinary clays in fresh water would be a filter loss from 20 to 35 cc, depending upon the colloid you got.

Q. How about bentonite? A. Well, bentonite drilling muds would have a water loss on the order of 10 cc.

Q. And now suppose that salts get into that drilling fluid. What effect would that have upon bentonite or the ordinary clays? A. Salt will flocculate the clay colloid in both bentonite and ordinary clay. The more salt present, the greater is the flocculation, and if you get salt in there approaching the concentration of 23 percent, you will get a water loss of 125 or 150 cc.

Tr. 41 Q. Do you know anything about these gums and seaweed, that is, Irish moss and tragacanth, things like that? A. Yes.

Q. Have they been used in drilling mud? A. Just occasionally. I would say that is more or less of an experimental use.

Q. How about starch? A. Yes, I am familiar with the use of starch in muds.

Q. When did you first get familiar with that from a commercial standpoint? A. Oh, I heard about it in 1941. I didn't see it until late in 1941 or early 1942.

Q. Did George E. Cannon of Humble Oil Refining Company tell you about it in 1938? A. No.

Q. Did anybody from Humble Oil Company tell you about it in 1938? A. No.

Q. You talked about starch. Was that raw starch? A. No. The starch I am referring to is gelatinized starch.

Q. What do you mean by gelatinized starch? A. That is one that will assume a gel structure in water, an emulsoid colloid.

Tr. 42 Q. Now, how can that be done, to make a raw starch into a gelatinized starch? A. Corn starch can be gelatinized either by boiling for some period in water, or it can be gelatinized in the cold if the water is alkalized to approximately 1 percent by weight with sodium hydroxide.

Q. Did you know anything about that before 1941, that starch could be gelatinized by caustic? A. Oh, yes.

Q. It was a regular thing taught in college, wasn't it? A. Yes.

Q. When starch is gelatinized by caustic, what ratio is generally used? What is the general ratio of starch to caustic that is generally used where you gelatinize it that way? A. Now you are talking about——

Q. Commercial stuff. A. The preparation of——

Q. What is that? A. The preparation of starch, gelatinized starch?

Q. Yes. A. If it is to be done in the cold, there should be at least 1 percent caustic soda in the water, and the quantity of starch can be anything that is convenient.

Tr. 43 Q. Do you know what they actually used in practice in 1940, what ratio of starch to caustic? A. Well, it had about 10 percent of starch, at least 1 percent of caustic, which would be a 10 to 1 ratio of starch and caustic.

Q. Do you know whether starch can be gelatinized with lime? A. No, not in the cold, it can't be.

Q. When your company started out to sell starch for the use of oil well drilling, when did they start? A. 1941.

Q. Now, what was the result? A. We had mediocre success in West Texas and New Mexico. The starch treated muds would ferment, unless the mud was saturated with salt as the result of drilling through the rock salt. After the salt was cast off and the percentage of salt dropped in the mud to less than saturation, it would ferment and would be abandoned. For that reason our sales were confined to West Texas, New Mexico, and just sparsely in the Gulf Coast and Mid-Continent region.

Q. That was gelatinized starch, was it? A. That was pre-gelatinized starch we sold.

Q. It worked all right in concentrated salt solution? A. Yes, it did.

Tr. 44 Q. What percentage was that, about, where you found starch to work in salt water? A. Our usual treatment would be from 1 to 3 percent starch in the mud.

Q. What percent concentration of salt was necessary to prevent that fermentation? A. That saturated salt solution of about 23 percent salt in water.

Q. What caused this fermentation, any way, of the starch? A. It is a wild yeast that is present everywhere.

Q. Did you try any of the bug killers? A. Yes, creosote was added to the muds that were in danger of fermenting, but that didn't stop it.

Q. Did you sell mud starch before 1943? I mean gelatinized starch? A. No, not very much. I have a tabulation of sales.

Mr. Bruninga: I will offer that in evidence later on, because otherwise it will get out of step.

By Mr. Bruninga: Q. You didn't sell very much at that time? A. No, it was just occasional sales before 1943 and that into the region where the muds were saturated with salt.

Q. How about from 1943 on, when this application was filed in 1943? A. The sales increased very rapidly after that date.

Tr. 45 Q. What is being used today? What did you begin using in 1943? A. We heard about the discovery in the Mid-Continent of alkalizing the mud to a pH of 12 or higher that would stop fermentation, and on the Gulf Coast where I was stationed, we tried it and found that that was correct, and that practice has continued ever since.

Q. Do you know Sikes and Beesley, the applicants in this application in suit? A. I know them, yes.

Q. What did they have to do with that? A. Beesley and Sikes are the ones that discovered this procedure.

Q. What is the procedure, briefly? A. It is to add alkalis to the drilling mud until the pH reads 12 or above, and add the starch to the system, and in your subsequent treating and maintenance of the mud system, to always hold the pH at 12 or above.

Q. What kind of starch do you add to this? A. Pregelatinized starch.

Q. Is that sold under any name? A. Yes, that is known as our product called Impermex.

Q. When you bring the alkalinity up to 12, what do you use for doing it with, caustic? A. Soda and quaebracho, as one system, or you can use lime and quaebracho, or a mixture of the three.

Tr. 46 Q. What is the purpose of the quaebracho in that case? A. That is to help control the viscosity, hold it down, reduce it. It would have gone up if the caustic itself had been added.

Q. What was the net result of using that system, of using a pH of 12? A. Then we took the prepared starch muds that were not in danger of fermenting and therefore the starch muds have a great advantage over the clay muds, under certain conditions. Our sales increased tremendously.

Q. You say it is also done by, it is either by caustic soda, or by lime, is that right? A. Yes.

Q. What limes? Is it hydrated lime or quick lime? A. That is the regular hydrated lime, calcium hydroxide.

Q. And the caustic soda is sodium hydroxide? A. That is right.

Q. But you use gelatinized starch to put in there? A. That is right.

Q. What is done there during the course of drilling? What do you keep track of, outside of the viscosity and weight that you have talked about? A. Well, drilling engineers will keep track of many characteristics of the mud besides the weight and viscosity, the gel strength, which indicates the speed with which the mud changes from a more or less fluid body to a semi-gelatinized one. Tr. 47

They keep track of the filter loss, of the contaminants that are in the mud, such as calcium sulphate or sodium chloride.

Q. What is used actually to determine the pH here, the alkalinity of the mud, to keep it at 12? A. Sometimes a Beckman pH meter is used. Sometimes litmus paper or such indicators that change color and indicate the pH of the mud or of the filter.

Q. You can actually bring a drilling mud, then, up to a pH of 12 and put in gelatinized starch and it will work, is that right? A. That is right.

Q. Even though lime itself will not gelatinize that starch, is that right? A. Yes, that is right.

Q. So you have to gelatinize your starch first, before you ever put it into that drilling fluid at a pH of 12? A. That is right.

Q. Are there measurements taken of this water loss? A. Yes. Filter loss or water loss are the same.

Q. How low is the water loss obtainable with starch?

A. By using large quantities of starch you can reduce the API water loss to 1 cc of loss.

Q. What can you get there for instance, with 1½
Tr. 48 percent, 2 percent of starch? A. 2 percent of
starch would probably result in a water loss of
3 to 4 cc.

Q. Is that desirable? A. Yes, that is.

Q. Is it deemed desirable in the trade to reduce it down from 10 to 3 or 5? A. Yes. In certain fields it is mandatory to reduce the water loss as low as possible, because that loss of water from the mud into these certain fields will reduce the rate of productivity of the resulting oil well.

Q. Suppose that you kept your drilling fluid at a pH of 12, and you put in your gelatinized starch. Would fermentation take place? A. No. Whenever the muds are maintained at pH 12 or higher, there will be no fermentation of starch.

Q. Suppose you don't watch it and it goes down below 12, I think the application said 11.5, 11.7? A. Some place below 12 fermentation will start up and unless alkalis are added to the mud as it is in use and the pH will drop downwards.

Q. Are you familiar with that is going on in the oil fields in the United States? A. Yes, I am.

Q. Do you have occasion to drive around to see
Tr. 49 what is going on? A. That is right.

Q. You get reports from your engineers? A. Yes,
I do.

Q. How many engineers do you have on the job watching these fields? A. The company as a whole has between 125 and 150. I am more closely connected with the Gulf Coast region, where there are between 50 and 60.

Q. Do you have meetings, where you meet all of them? A. Yes.

Q. What about the API meeting in Chicago? A. There we will meet not only engineers, but the superintendents of engineers, superintendents being in charge of a half dozen or so of engineers.

Q. Can you give the Court an estimate of what percentage of starch you think is being used, gelatinized starch, used in accordance with this pH 12 system? A. I think that at least half the true gelatinized starch that is used in drilling muds is used in the high alkalinity pH 12 environment.

Q. Where they have salt, drill through salt, then they don't need it? A. You don't need it if the mud is saturated with salt.

Tr. 50 Q. Suppose you don't watch that thing, you might have your drilling fluid, your thousand or two thousand barrels at an alkalinity or pH of 12, and then you start drilling and don't pay any more attention to it. What happens then? A. The pH of the mud will gradually drift downwards from 12 because of the dilution with water and the reaction between the caustic soda and clay mineral in the mud, and at some point below there, perhaps around 11 to 11.5 pH, fermentation of the starch will set in. That destroys the starch content and the mud, the characteristics are even worse than they were before you added the starch. In extreme cases you would have to throw away the whole mud system and start building up another one.

Q. You must maintain the pH? A. Yes, the pH of the mud must be maintained constant so fermentation will not set in.

Q. How about maintaining the water loss? You watch that? A. All of the characteristics are subject to change as drilling proceeds, and it is the job of the mud engineer to balance the items of his ingredients constantly, so that he at all times has the mud of uniform characteristics.

Plaintiff's Exhibits 1, 1A, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12 were offered and received.

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Tr. 55 By Mr. Bruninga: Q. What does that give you, that PX-12, it is marked? A. I prepared this on company sales of our pregelatinized starch, Impermex. We have three columns, that is, Pacific Coast and Gulf Coast, and then we sell some materials in export. These figures represent the tons of Impermex sold per year in each of these three operating divisions and in export, and I have totalled them by years and given a total for the quantity for that time of 53,646 tons.

Q. In what country outside the United States have you sold your Impermex? A. Sold it in Venezuela, Iraq, Iran, some in Canada. That is all I can recall.

Q. Dutch East Indies? A. I think we have sent some to the Dutch East Indies, too.

Q. This is marked "Impermex." This Impermex, I think you said, I know Mr. Larsen has said, is gelatinized starch made in accordance with the Larsen patent? A. That is right.

Q. When you sell that starch, how does it come,
Tr. 56 mixed up with water? A. No, it is a dry powder packed in 50-pound paper bags, and is delivered that way to the oil field.

Q. I noticed that in 1941 you say you started, is that right? A. Yes, sir.

Q. In 1941 you sold a total of about 446 tons, in 1942 you sold a total of about 677 tons. Now, in what fields were they sold? I see they were Mid-Continent and Gulf Coast. A. Most of that was sold in West Texas, New Mexico areas, and in conjunction with saturated salt water mud.

Q. The Mid-Continent, was that a saturated salt water mud? A. Yes, West Texas and New Mexico.

Q. How about the Gulf Coast? What kind of muds were there? A. They were used in the normal pH mud of 8 to 8.5, and they are the ones that gave us trouble with fermentation.

Q. They were used, nevertheless, though, weren't they? A. Yes, we used them. You can see from the tonnage that was most infrequent, and everyone of them gave us trouble.

Q. You have to take your starch fluid out of the well and start over? A. Well, it takes about four or five Tr. 57 days for fermentation to start, and we hope to finish our job before that elapsed time. If we didn't, we had to throw the mud away.

Q. How long it would take to drill a well depends upon conditions, does it not? A. Oh, yes. It takes anywhere from 20 days to several hundred days, but this application in the Gulf Coast, just at the finish of the well, we hoped to get it finished before fermentation.

Q. But in the Mid-Continent, that is where you were drilling through salt? A. Yes. We did not have the rock salt.

Q. This application was filed in 1943. There is shown a jump in the Mid-Continent to 1,831 tons. A. That was because the operators were no longer afraid of the starch fermenting. We demonstrated to them if the pH was held up to 12 the starch would not ferment.

Q. Even in the Gulf Coast in 1945 it jumped up from 42 in 1941 to 1,507. As a matter of fact, did you have any trouble with fermenting since that time where the fellow was on the job and watched the pH? A. No. It won't ferment if the pH is at 12.

Q. I notice some of those big sales in 1943, 1944 and 1945, not only in this country but some foreign export, the last, that was done when we were at war? A. That is right.

Tr. 58 Q. You mean to say you were permitted to use starch in wells when people needed it to eat? A. Yes, they did.

Q. Did you try to conceal it from the Government? A. Oh, no. In fact, we had to call upon the War Production Board to help us, and help Corn Products get more pregelatinized cars to meet the increased demand.

Q. How many carloads? You say about six thousand some tons? A. Well, figure about 30 tons to the carload. It would be 200.

Q. It would be trainloads, is that right? A. Yes, that would be several trainloads.

Q. And that jumped up in 1943, after you came along, you mean to say after—and you had a time doing that sort of thing in 1941, even though, as it happens, the Cannon patent was issued in 1938 and the Stern publication came out in 1941? A. We knew nothing about the fact that a high pH would kill the yeast and prevent fermentation until Sikes and Beesley told us about it.

* * * * * * *

Tr. 61 Mr. Bruninga: Your Honor, as I stated in my opening statement, the two references, as far as prior art relied upon are the Stern publication of February, 1941, which is DX-D, and the Cannon patent, 2,109,858, DX-A.

The other two publications are just relied upon to show physical facts, that is, if you add a certain amount of caustic, you get a certain alkalinity or pH, which is not disputed at all.

By Mr. Bruninga: Q. Mr. Farnum, did you know Mr. Stern, the one that wrote this article for the Bureau of Mines? A. Yes. I met him when he made a trip through the oil fields of the South prior to writing this statement.

Q. Where were you at that time? A. I was in Houston.

Q. Mr. Stern in his paper refers to George E. Cannon of Humble Oil & Refining Company, Houston,
Tr. 62 Texas, on page 77. Do you have that footnote in the corner, that Stern article?

The Court: Page 77. Yes, I have it.

By Mr. Bruninga: Q. Do you know George Cannon? A. Yes, I have known him about 20 years.

Q. And he was with the Humble Oil & Refining Company at that time? A. Yes, he was.

Q. He is still with that company? A. He is still with that company.

Q. What is his position over there? A. He has had various positions as a chemical engineer or petroleum engineer attached to their drilling and production department.

Q. He is a capable man? We don't dispute that, do we? A. Yes, very much so.

Q. Mr. Stern's article, and I don't think counsel objects to this exhibit being read, was really a review in February of 1941 of what has been done with these drilling fluids, is that right? A. Yes, that is what I understand from reading it, that he has recited in here the state of the drilling art as he so found it after talking to the people in the field.

Q. He talked to you about what your people had done? A. Yes. Tr. 63

Q. The Baroid Sales Division of National Lead Company? A. Yes.

Q. At that time you had actually put out Impermex, gelatinized starch? A. Yes.

Q. You had not developed this pH of 12? A. That is correct.

Q. Now, Mr. Stern makes this statement, page 76, "Gums and starch (underlining): Several gums have been suggested and used as sources of colloidal material. They have been investigated because of the difficulty from the use of bentonite resulting in flocculation by salt water or other electrolyte. Gum tragacanth and several other organic gums have been tried, but the cost was prohibitive." What is your recollection of that? A. I know that a few of the companies, one in particular the Gulf, drilled a well in the New Orleans area, using gum tragacanth to reduce the filter loss of salt contaminated mud, and although they accomplished the aim, it was most expensive and the gum slowly putrefied. It was not followed continuously.

Q. Now, these gums like gum tragacanth, were those a substitute for bentonite or a substitute for quaebracho? A. Yes, they were a substitute for bentonite. Tr. 64

Mr. Bruninga: I call Your Honor's attention to the Harth patent, PX-8, No. 1,991,637. Do you have it there?

The Court: Let me have the exhibits.

Mr. Bruninga: If you haven't, I have got another copy, so I can go right on. Do you have a copy?

The Court: The Harth patent?

Mr. Bruninga: Yes. Here, sir, I have got plenty of copies.

The Harth patent contains the following statement, after referring to bentonite. At page 2—do you have a copy of it, Your Honor, the Harth patent? It is on the right-hand side, about two-thirds of the way down.

The Court: Oh, yes.

Mr. Bruninga: You have it there? It says: "Some authorities have classified bentonite as emulsoid colloids, particularly because of this characteristic of water absorption and swelling. Other suitable concentrated colloidal suspending agents and more particularly emulsoid colloids may, however, be employed to attain some or all of the objects and advantageous features of this invention. Examples of these are starch, gelatin, sodium silicate solutions, gum tragacanth, agar, casein glue, soy bean glue, albumin, and other similar substances"——

Tr. 65 By Mr. Bruninga: Q. Were all of those substitutes for bentonite or for quaebracho? A. No. Those are substitutes for bentonite.

Q. Now, then, continuing with Mr. Stern, he says that starch has been mentioned as a mud addition. However, in the patent literature, notably by Harth and Cannon, Harth mentioned it as an alternative for bentonite, while Cannon discloses its use with high concentration alkalis for drilling through heaving shale.

Your Honor, that reference 60, counsel will admit. I have talked to him. That is the Harth patent you have just referred to. This Cannon is the very Cannon patent 2,109,858, that Mr. Stern referred to.

Now, we will come to that Cannon patent later on, but he said then that "starch is inferior to bentonite in those muds in which bentonite is effective," namely, fresh water mud. Neither starch nor bentonite is effective to prevent filtration in salt water mud.

What do you take it he means there, starch, ungelatinized starch? A. This starch that he refers to is ordinary corn starch, not gelatinized.

The Court: Now, how do you know that?

The Witness: From the next paragraph you begin
Tr. 66 to talk about gelatinizing or hydrolyzing it, and
also from the contents—hydrolyzing or gelatinizing starch is the very thing we used in the salt contaminated mud. Corn starch by itself is just so much inert material.

The Court: Why wouldn't he have said that?

The Witness: I think he says that.

The Court: If that is what he meant.

The Witness: If we will read this next statement, I think it becomes apparent. He first said starch is inferior to bentonite. Next, neither starch nor bentonite is effective to prevent filtration in a salt water mud. Then, it is only recently that starch has found application in drilling mud as a result of the development that hydrolyzed starch imparts a good filter test under salt water muds. Then the starch up above must be unhydrolyzed or ungelatinized, which is the ordinary corn starch.

The Court: But it does say hydrolyzed starch is known, the line you just read?

The Witness: That is right, but you see he is building up his procedure of adding the hydrolyzed starch to the mud. First, starch by itself, or, let us read "corn starch," is inferior to bentonite. Neither corn starch nor bentonite is effective to prevent filtration in salt water mud. There, next, it is only recently that starch has been found applicable in drilling muds as a result of the develop-
Tr. 67 ment that hydrolyzed starch imparts a good filter
test to salt water muds. That is factually correct.

The raw corn starch isn't in the proper state to reduce the filter loss of a salt contaminated mud, but the hydrolyzed starch is.

Mr. Bruninga: Your Honor, we can back that up by a contemporaneous paper that appeared in the same month as this one. I will come to that in a minute now.

He says then that for this purpose starch may be hydrolyzed by boiling the 10 percent suspension in sodium hydroxide, 1 percent by weight of starch, sodium, hydroxide, 10 to 1.

By Mr. Bruninga: Q. I think you referred to that 10 to 1 ratio before as one that was not practical nor used? A. Yes.

Q. Do you know whether that was actually done in the field, using this 10 to 1 ratio of starch to caustic? A. Yes, that was done in the field. The raw corn starch was cooked up in an alkaline solution, and the resulting paste was added to the salt contaminated muds. That was done principally in West Texas and New Mexico.

Q. Had it been done at the time Mr. Stern gave this paper? A. Yes, it was done before this by about a year or so.

Mr. Bruninga: I want to call your attention to a paper——

Tr. 68 The Court: Now, the last sentence following what you read of that application——

Mr. Bruninga: I was going to come to that, but I can dispose of that right now. He says a pH of about 11 or 12 is desirable. How do you read that, as applying to the pH of what?

The Witness: That is the pH of the starch suspension he is cooking up.

By Mr. Bruninga: Q. Do you find he says anything about the pH of the drilling fluid itself? A. No, that isn't mentioned in here, and it has no bearing at all, on cooking up the starch paste from the drilling mud system.

Q. Where you actually boil this starch and caustic in order to gelatinize it, what can your pH be in that case? A. The pH in the starch-water mixture that is being gelatinized must be greater than, oh, about 12.3, 12.4. You should have at least 1 percent caustic in there.

Q. Suppose you boil it, instead of it being in the cold. What is it, then? A. Starch will gelatinize at a lower pH if it is boiled.

Q. Will it gelatinize at 11 if it boils? A. Yes.

Q. Summarized, then, what do you gather from
Tr. 69 that statement about the 10 to 1 ratio and about
the pH? A. Mr. Stern is telling what he has seen in the fields. He is describing the method of hydrolyzing ordinary corn starch. They make up a 1 percent caustic water mixture, add the corn starch to it, and cook it until it gelatinizes. That is the mixture that is added to the mud, and the pH of this mixture while it is cooking may be between 11 and 12.

Q. I want to call your attention to PX-7, which is an article by Gray, Foster & Chapman, presented at the New York meeting of February, 1941, of the American Institute of Mining and Metallurgical Engineers. You belong to that? A. No, I don't. I have attended their meetings, but I am not a member.

Q. Do you know whether that particular one we have over here that I gave to the Judge, that was presented by Gray with his compliments, I will say, do you know whether those papers were submitted before the meeting for discussion? A. Yes. The procedure of this society is to call for the papers before they are printed. They are circulated before the meetings to various members that might be called on to discuss them.

Q. Do you know Gray, Foster & Chapman? A. Yes, I know them.

Q. It is stated that they are with the Humble Oil & Refining Company. That is right, isn't it? A. They
Tr. 70 were at that time, yes.

Q. What part of the business were they in, the drilling end or the refining end of that company? A. In the drilling and production end. They are associated with the Mr. Cannon that we just talked about.

Q. Were the men skilled in the particular art? A. Yes, they were.

Q. Now, the paper is called "Control of Filtration Characteristics of Salt-Water Mud."

After discussing the gums and so forth, which we can skip, he proceeds with starch, and let us go right down to page 4, right-hand column, and this is the statement: "To be effective the starch must be gelatinized or pasted. The addition of dry starch or a dispersion of starch in cold water, whether untreated or the so-called soluble starch, is equivalent to the addition of a like amount of inert material." What do you know about that? A. I know that that is correct, that starch has no value as a filter loss reducing material in drilling mud unless it is gelatinized. That gelatinization consists in the rupture of the amylopectin film membrane and the swelling of the cell contents. This change in structure is revealed in Figure 6. That is on the next page. That is what actually takes place there.
Can you see it? The starch cells are ruptured,
Tr. 71 and the starch particles within the cell can combine with water and swell.

Q. He says then: "Among the various agents that accomplish the pasting of starch, the most potent is caustic soda. The relative amounts of starch and caustic soda may be varied between rather wide limits and the composition selected is determined by consideration of the convenience of handling the pasted mixture. A practical suspension for addition to drilling mud contains 10 percent by weight of starch and 1 percent of caustic soda." A. One percent by weight.

Q. One percent, was that what you were talking about, what they did over there in the field at that time? A. Yes. That was the usual mixture that was added to the salt mud.

Q. Then later on on page 7, on the right-hand column,

he talks about the use of starch in field tests, or, rather, they talk about it. He says: "The first field trial of gelatinized starch was made on a well in the same area as that of the gum tests. In preparing the pasted starch for field use, a box fitted with perforated steam coils was employed. Starch was intimately mixed with
Tr. 72 water by adding the starch through a mud-mixing
hopper. Caustic soda was added, and the white pasty mass was agitated with steam until a viscous straw-colored suspension resulted. The final composition of the mixture was approximately 89 percent water, 10 percent corn starch and 1 percent caustic soda." That is again the 10 to 1 ratio, is that right? A. Of corn starch to caustic soda, yes.

Q. As far as the preparation of that mixture is concerned, what relation does that have to what Mr. Stern talked about in the same month, the same paper? A. It is the same ratio of corn starch to caustic soda, and essentially the same concentration in the water. Then it proceeds: "The mud in the pit was stirred vigorously with the guns while the starch suspension was added." What does he refer to by "guns" there? A. Those are mud guns. They are the means of agitating the mud pit, or the mud is pumped through pipes vibrated back and forth, and thereby swell up the whole mud volume of the mud pit.

Q. This mud pit you talk of is 1,000 or 2,000 gallon capacity? A. That is right. Those are the surface pits.

Tr. 73 The next thing, he gives the proportions, and so on he uses, on the next page. Of course it is in connection with salt water. Now, assuming that that pH of that mixture was 12, 13, or anything else, you add that mixture to that mud in the proportions that are given there, what happens to the pH, what you know about clays of that kind in salt water. A. The pH of the salt laden mud, before the addition of starch and its caustic would be anywhere from 7.5 to 8.5 or 9, and if the starch mixture was added, the pH would increase slowly. If you add as much as to bring up the total starch in the mud to 1 percent, the pH of the mud mixture would be probably 9.5 to 10.5.

Q. But why would it be reduced, say, between 12 and 13 down to 9.5? A. Well, first, it would be dilution. You see, the pH is a means of mixing the concentration of alkali, actually the OH ions in the system, so you would have a reduction from the pH of the starch mixture in proportion to the dilution that occurred, which is of the order of 10 or 15 to 1. Next, there is a buffering action by both starch and clay that would prevent the caustic from giving out the maximum amount of ions possible. Thirdly, there would be a chemical interaction between the caustic and the clay mineral that would use up some of the caustic. All of those things contribute to the reduction of concentration of the OH ions.

Tr. 74 Q. What is meant by buffering action? A. That is an interfering action by which certain chemicals interfere with the reaction contemplated. In this particular case ionization of sodium hydroxide, where one can calculate how many sodium ions and how many hydroxide ions would result from a certain concentration. Sodium hydroxide under certain conditions can be added to this caustic mixture which prevents the sodium hydroxide from ionizing 100 percent.

Q. When you take that particular procedure he describes, and adding that 10 to 1 that Mr. Stern talks about to a drilling mud, and assuming that there is no salt in the drilling mud, no concentration of salt, will that pH be high enough to prevent fermentation? A. I would like to have that stated again. Taking a 10 to 1 mix of starch and caustic, 1 percent caustic. That would give a pH of somewhere between 11.5 and 12 in the starch mixture. If that mix is added to the mud in such quantity that the mud ends up with 1 percent starch, that pH will drop 1 whole point—drop 1 point by dilution alone, and an added amount by buffering. It would end up at lower than 12 percent, and the mud would ferment.

Q. In fresh water? A. Oh, yes, in fresh water.

Q. The fresh water being where you have drilling
Tr. 75 through clays? A. That is right.

Q. Where you have salt in it, in that case like in this paper over here, you don't need a pH of 12, do you, with a salt concentration? A. If the salt approaches saturation, 20 to 23 percent, there will be no fermentation of starch.

Q. Do you know Delmar Larsen? A. Yes.

Q. He gave a deposition there. Have you got it there? A. I don't know whether I have or not.

Q. Where is that article about Stern?

The Court: Here it is.

Mr. Bruninga: He can use mine.

By Mr. Bruninga: Referring to PX 5: Q. Mr. Larsen took three clays, an El Paso clay with salt concentration, and an Ada, and a Gulf Coast, with fresh water. Are you familiar with those clays? A. Yes, I am.

Q. The salt water at 1 percent in the two, at 1 percent starch, gave a pH of 9.4 or 8.5. He talks about the second one as after aging it, I think it was 18 hours. Why is a procedure like that employed, where you age the drilling mud? A. You don't get full reactions immediately. And in order to characterize any change in the mud, we usually
age them on 150 Fahrenheit overnight and measure
Tr. 76 again. That will more closely approximate the
changes occurring in the drilling well.

Q. I suppose in order that you put in enough caustic to carry up the pH, is that right? A. That is right, and reactions that might be contemplated.

Q. In those two in Ada, take, for instance, the El Paso, 1 percent is pH 9.4 to pH 8.5. From your experience—or, have you had experience with those clays? A. Yes, I have.

Q. From your experience with those clays do you think those are wrong or right? A. No, that is close correct, to me.

Q. Now, the next one, the 1 percent with the Ada salt is

10.5 and 9.7. Are you familiar with the Ada clay and salt water? A. Yes, I am.

Q. That was a concentrated solution. Do the pH's look right or wrong? A. Those look right to me.

Q. In the next one, Mr. Larsen took a Gulf Coast fresh water. Is that more favorable or less favorable to a pH proportion? A. The use of fresh water is more favorable to maintaining the high pH.

Tr. 77 Q. But still the pH at 1 percent is given at 10.6 after aging? A. Yes.

Q. How does that look to you with your experience with those muds? A. That is about where it should be.

Q. In all of these three muds, the pH of 9.4, 10.8 and 10.9, if they were fresh water muds or not sufficient salt to preserve them, would they ferment, or would they not? A. They would ferment.

Q. In order not to do that you would have to maintain a pH of about 12, you said, I think? A. In order to prevent fermentation of starch the pH must be approaching 12.

Q. Do those experiments confirm or are they contrary to what you said happens in actual practice of that PX-7, the paper on adding a 10 to 1 ratio of starch to caustic to a drilling mud, which you said went below 10.12, how does that compare? A. These experiments compare with the results occurring in a field when a 10 percent starch solution is added to those types of muds.

Q. I want to call your attention now to something from Mr. Stern, on page 77. He says that one important point is that starch tends to ferment unless a preserva-
Tr. 78 tive is added. An effective preservative is sodium chloride (salt), so that it is possible to accomplish a dual function when drilling through a salt formation. The salt does not flocculate the hydrolyzed or colloidal starch suspension, so that the desirable qualities of the mud are not destroyed, and the salt that does enter the mud acts as the preservative to prevent the fermentation of

the starch. A salt concentration of about 10 percent is adequate.

I am going to skip a little bit, but I am going to read what is in between later.

He says this starch treatment is less expensive than sodium silicate drilling fluid, and according to Cannon may be at least equally as effective.

What relation does that disclosure of Stern have to the very thing disclosed in this paper, this PX-7, the Gray, Foster and Chapman paper? A. It was on the same subject matter.

Q. He says: "It is surprising that the hydrolyzed starch does not increase the viscosity of the mud (in fact, reduces it slightly) and that the main effect is an improvement in the filter test, even when salt conditions are met."

Now, he says it reduces it slightly. Mr. Stern was talking about without any tests at all. Refer to page 6 of that Gray, Foster and Chapman paper, PX-7. It shows a figure there, the Figure 7, which has a viscosity curve
Tr. 79 and a water loss curve. What does that show? A.
This represents the reduction in water loss and changes in viscosity in a salt contaminated mud as hydrolyzed starch is added at various quantities. We can pick out certain points here. The mud before any starch is added had a water loss of 70 cc and a viscosity of about 9 centipoises. When .6 of a percent by weight of starch was added to the mud, the water loss was reduced to about 26 cc, and the viscosity had risen to 22 or 23 centipoises. That is carried on until ultimately with the addition of about 1.5 percent by weight of starch, water loss is reduced to about 4 cc, and the viscosity is at 22 centipoises.

Q. What do that show? Does it show the viscosity increases or decreases? A. It shows that there is an increase, a general increase in viscosity of the mud as starch is added to it. There is a spot in here where it drops for a short while from the peak and then continues to rise.

Mr. Bruninga: I don't think counsel will object to this as leading, because he can read this curve just as well as I do, but for the information of the Court, as you add starch, the viscosity increases.

The Witness: Yes.

By Mr. Bruninga: Q. Then it goes down some, but
Tr. 80 not below the initial viscosity? A. That is correct.

Q. Then it rises again? A. Yes.

Q. So, as far as the initial viscosity is concerned, the starch has not decreased it, but it has increased it? A. That is right.

Q. Then it starts rising, and it increases? A. That is correct.

Q. And the pH you really want, at a pH of 5, which is stated in the claims here, is it an increase or decrease in viscosity—— A. You asked——

Q. No, no. Not a pH of 5, a water loss of 5. A. At a water loss of 5, the viscosity is about 21 centipoises, where the original mud had a viscosity of 9 centipoises.

Q. In our application, if you will look at the drawings, you find the same thing, don't you?

I think counsel will probably refer to that if I don't, so I had better call attention to it. In the application that we have here in suit in the drawings, Figures 1 and 2 show an increased viscosity? A. Yes.

Mr. Bruninga: Have you got the drawing? If you
Tr. 81 haven't, I will give it to you.

The Court: Here it is.

Mr. Bruninga: The Court has one. Here it is, right here.

By Mr. Bruninga: Q. In Figures 1 and 2, the viscosity is rising, is it not? A. That is correct.

Q. That is with the clay, just a clay containing starch, and with the other one, Figure 2, with the clay containing some sodium chloride? That is right, isn't it? A. That is correct.

Q. But in Figure 3, where you have calcium sulphate, there is a drop in the viscosity initially, isn't that right? A. Yes, that is shown here.

Q. Can you explain why that should be in that particular drilling mud containing calcium sulphate? A. The mud before the addition of the starch is in a badly flocculated state. That is due to the presence of calcium sulphate, which is a strong flocculating agent for the clay colloid. Flocculated muds have very high viscosities, and the addition of the first small quantities of starch will first coat these flocks so that they don't offer so much internal resistance, don't offer the same viscosity. Next, remember that the starch is accompanied by sodium
Tr. 82 hydroxide, also, and there is an interaction between the sodium hydroxide brought in with the starch and the calcium sulphate present in the mud to the effect that the calcium ion becomes precipitated as calcium hydroxide and although sodium sulphate will be present from this interaction, sodium sulphate is only about one-fourth as flocculating as calcium sulphate, so we get a viscosity reduction because we have deflocculated this original mud.

Q. What you have done is you have taken the calcium sulphate out of that plane and converted it into something else, is that right? A. Yes.

Q. You know in that viscosity there is a straight line there. Actually, that straight line, should that be straight, or how should it go? A. No, that is just some draftsman putting that in there. All these curves will be somewhat as they are in Figure 1 and Figure 2.

Q. At about what point in the curve will the viscosity be the lowest? A. I would smooth out that viscosity curve from the two points at the bottom and arrive at a minimum viscosity of on the order of 13 centipoises.

Q. Can you sketch that on the Judge's copy, this matter of drawing straight lines when there should be
Tr. 83 curves on there? Take the Judge's copy and just mark it on in pencil.

You have to talk loud enough. A. The curve should not be angular but should be smoothly changed as those are in Figures 1 and 2, so I would project that viscosity curve downward to a minimum of about 30 centipoises.

Mr. Bruninga: That will be PX-1-A, anyway, because the Commissioner has a clean copy in there. The Judge has our PX-1-A, and if you just interchange the thing, you have the same thing. Can you do it?

The Court: That doesn't amount to an amendment to your claim?

Mr. Bruninga: No, that is just a scientific fact. I don't think Mr. Miller will deny that.

The Court: I understand that, but does it amount to an amendment to your claims?

Mr. Bruninga: No. No, it does not.

The Court: All right.

Mr. Bruninga: If you just give the Judge your copy, we will be all right.

By Mr. Bruninga: Q. Mr. Farnum, however, let us take the point where the viscosity begins to rise. In our claims
we are talking about something having a water
Tr. 84 loss of 5, at least 5, on the order of 5? A. Yes.

Q. At the water loss of 5, where it crosses the 5 line, where is the viscosity? Has it increased? Is it increasing or decreasing? A. The viscosity is increasing at the point where the water loss is 5.

Q. The authors say here, PX-7, page 5: "Addition of gelatinized starch often results in erratic variations in the viscosity of salt water muds." That is about what you get? A. That is right.

Q. Let us keep on with this thing. So, as far as the Stern reference is concerned, do you find it any different than the PX-7, Gray, Foster & Chapman? A. No. It is on that same subject, and the same figures are used throughout.

Q. Now, let us take up the Cannot patent, which is the last one. Tell the Court what you know about that. Do you know, actually, what that procedure in that patent is about? A. Yes, I do.

Q. Have you seen it work? A. Yes, I have.

Q. What did you see? A. I have seen the Humble Com-
pany and others use the subject matter of this
Tr. 85 patent in drilling through what we call heaving
shales in coastal Texas and Louisiana, and the
process consists of using very large amounts of the ordi-
nary mud treating chemicals, caustic and quaebracho, and
maintaining the mud at a certain minimum alkalinity
throughout the drilling.

Q. We can say it is a minimum alkalinity of 12, can't we? A. What?

Q. I say we can say that mud was maintained at an alkalinity of 12 pH, can't we? A. Oh, yes.

Q. All right. We will get rid of something. We can say that, can't we? A. Yes, that Cannon mud is above 12 pH.

Q. What does he employ to get that alkalinity? A. Caustic soda.

Q. He also mentions lime, doesn't he? A. Yes, he can use lime.

Q. What does he use besides caustic soda in that drilling mud? A. He uses large quantities of quaebracho, and, if necessary, bentonite.

Q. Will every one of his claims state that he uses
bentonite? A. Yes. I think there is one place in
Tr. 86 the patent where he says he might use it.

Q. What does Cannon actually want to do there? What does he disclose what the purpose of the whole thing is? A. He shows that in having a high concentration of caustic and quaebracho, that the shale that we call heaving shale will not be attacked by the water, and will not swell, will not heave into the hole.

Q. Tell us a little bit about heaving shale. What is it? A. That is a shale member that is highly plastic, and when the water of the drilling mud gets in there, it will fall over, heave into the hole, sticking the pipe, and many times cause an abandonment of the drilling procedure. That has been the subject of quite a bit of study by Gulf Coast operators, and this is one of the processes offered for successfully combatting it.

Q. And he mentions the high percentage of caustic, is that right? A. That is right, high percentage of caustic and quaebracho.

Q. And a high percentage of bentonite? A. Yes.

Q. The ordinary drilling mud, what is about the maximum of bentonite you put in there? A. 2 to 3 percent.

Tr. 87 Q. And Mr. Cannon on page 2 talks about 10 to 30 percent? A. Yes.

Q. If you have, say, 5 percent or 6 percent of bentonite in a drilling mud, what happens to the drilling mud? A. As much as 5 percent of bentonite in a fresh water drilling mud would cause it to be so viscous it probably couldn't be pumped.

Q. What do you use to cut that viscosity down? A. Another treating chemical, such as caustic and quaebracho, or polyphosphates.

Q. That was done years ago, wasn't it the practice years ago? A. Yes, especially about 1930 or 1931.

Mr. Bruninga: I call attention, Your Honor, to the Lawton et al. patent, 1,999,766, PX-11.

By Mr. Bruninga: Q. You are familiar with that patent? A. Yes, I am.

Q. They use the caustic and quaebracho there, don't they? A. That is right.

Q. What percentage of caustic did they use in that case with the quaebracho? A. Much smaller amounts,
Tr. 88 on the order of one-fourth of 1 percent to 1 percent by weight of the solids in the mud.

Q. What would 1 percent be by weight of drilling muds, be about 2 percent—tell us what it is. I think you figured it out 2 percent as far as the water is concerned. That 1 percent was of solid content, wasn't it? A. Yes. That is for the Ambrose, Loomis and Lawton tests. There you use from one-fourth of 1 percent to 1 percent by weight of the solids that are in the mud.

Q. And what percentage is that of the drilling fluid itself? We are trying to get it in Cannon's terms. A. Of the drilling muds, well, you have about 20 percent solids, 8 percent water.

Q. What is the density of the solid matter as related to the percentage in the whole drilling mud? A. About one-fifth of that, or .2 percent by weight.

Q. In other words, one-fifth of a percent, is that right? A. That is correct.

Q. Of caustic? A. Yes.

Q. And that is used with a tannin like quaebracho, is that right? A. That is right.

Q. Now, what has been the purpose of using caustic and quaebracho in the preparation of drilling muds?
Tr. 89 A. The use of those chemicals as described by Ambrose, Loomis and Lawton is to reduce the viscosity and reduce the gel strength of ordinary muds.

Q. When Mr. Cannon uses larger quantities, he says one-third of 1 percent by weight of caustic on page 2, but then he goes as much as 2 percent or 3 percent of caustic with quaebracho, why does he use those larger percentages? A. He is after an entirely different result than Ambrose, Loomis and Lawton. He is making a solution that will actually pickle the heaving shale, and not permit it to disperse into the mud.

Q. When you use those large quantities of bentonite as distinguished, 10 to 30 percent, as distinguished from, say, 3 to 5 or 6 percent, do you have to use more caustic and quaebracho to knock the viscosity down? A. Yes. That is part of the function of your high percentage of caustic and quaebracho. It reduces the viscosity that would have been obtained by the large quantity of bentonite.

Q. He says on page 2, right column, about line 71 that sufficient bentonite is present in the drilling mud to render the mud excessively plastic except that your plasticity is reduced by the addition of tannic acid or the like, plus alkali in such amounts, that the resultant drilling Tr. 90 fluid does not attack the heaving shale. What does he use tannic acid for there? A. That is to reduce the viscosity of the bentonite suspension.

Q. Now, Mr. Cannon in his patent on page 2 lists, beginning with quaebracho as the only example he gives, a large number of materials. What are those? A. Those are all tan stuffs, source of tannic acid, and the extraction of them would reduce the viscosity of a drilling mud if used either this way or in the way Ambrose, Lawton and Loomis teaches.

Q. He calls attention before that to tannic acid, lumic acid, and pyrogallic acid. All of those are acids, are they not? A. Yes.

Q. Are they all related in this respect? A. Yes, they are the same group, and they will all react as viscosity reducing agents.

Q. They are all mentioned in the Ambrose, Lawton and Loomis patent? A. Yes.

Q. They have all been used in the past, haven't they? A. That is right.

Q. And they have been used with caustic, is that right? A. Yes.

Q. And do you get a better effect by using caustic Tr. 91 with the tannin or the tannic acid, or lumic acid, and so forth? A. It is best to use tannic acid in conjunction with the caustic.

Q. In fact, today that is called a caustic tannin treatment, is that right? A. That is right.

Q. And it has been known as that for years, has it not? A. Yes.

Q. Mr. Farnum, Mr. Cannon states on page 2, left line 4, that he may use starch. The Examiner says if you substitute starch for quaebracho in the Cannon formulas on page 2 that you get what we have. Have you seen anything like that performed, trying to substitute starch for quaebracho? A. Yes. I have done it myself.

Mr. Bruninga: Your Honor, we will just perform some very simple, short experiments.

I wish, Mr. Farnum, that you would show the Judge what water with 10 percent bentonite is.

And that is the only one, Your Honor, that we made up last night, because we had to have time to permit it to hydrolyze. I don't think counsel will question that.

By Mr. Bruninga: Q. Will you show him a bottle Tr. 92 in which the water contains 10 percent? You have two bottles of bentonite? A. This is a mixture of 10 percent of bentonite and 90 percent water.

Q. Could you use that as a drilling mud? A. That would be rather viscous to use as a drilling mud.

Q. I would like to have you show the Judge or make up right here, it will only take you a minute, make up a water containing 2 percent starch, raw starch. Will you do that now? That will be bottle No. 2. The other ones are 1 and 1-A. A. This is a 4-ounce bottle.

Mr. Bruninga: There is nothing tobe hurt on your desk, or anything, with this experiment.

The Witness: That is approximately 120 cubic centimeters to the top, and an estimated 50 cubic centimeters of water in there.

I had a druggist weigh out exactly 1 gram of ordinary corn starch, so that when I put that in there, that will be 2 percent by weight.

I estimate this to be 50 cubic centimeters, not quite one-half of the volume of the bottle.

I will add this 1 gram of ordinary corn starch.

It doesn't gelatinize. It becomes finely divided and will fall to the bottom of the jar.

Tr. 93 By Mr. Bruninga: Q. In other words, you said the starch, the raw starch, is absolutely inert? A. That is right.

Q. And it will settle in water, is that right? A. Yes, sir.

Q. It will settle before we get through? A. Yes, sir.

Q. I wish, then, that you would also prepare 50 cubic centimeters of water with 2 percent of quaebracho extract. A. I have here a jar containing approximately 50 cc of water, and in this envelope is 1 gram of tannic acid which I purchased from a druggist who weighed it out here for me. Tannic acid is the active ingredient in quaebracho as far as reducing the viscosity in the drilling mud. When added to the water, it immediately goes into a solution.

Q. By the way, what is ink? A. Ink is a reaction product of iron salts and tannic acid.

Q. You have, in that case, in the bottle No. 2, you have a starch which is a solid and which will settle? A. Yes, sir.

Q. And you have in bottle No. 3 a caustic plus water. That is a solution, isn't it? A. Yes, sir.

Tr. 94 Q. Can't you say that they are the opposite ends of any scale, a solid and a solution? A. Well, one will be dissolved in the water and the other is insoluble in water.

Q. All right. I wish you would perform another brief experiment with No. 3 and add 2 percent caustic, like Cannon does, that is, one gram of caustic soda. A. I determined it took 7 of these sodium hydroxide pellets to equal 1 gram. I couldn't weigh these out before-hand, because they pick up water very rapidly, but the pellets are all the same size, and I will pick out 7 of these, which will be 1 gram or 2 percent.

Put that where?

Q. What is that? A. I have the gram of caustic soda.

Q. Put that in the bottle that has the quaebracho in it, or the tannic acid. A. I will put one gram of caustic soda in the bottle No. 3. It will take a few seconds to dissolve this.

Q. You can start something else. You can do the same thing with bottle No. 2 where you have starch and see what happens then. A. This bottle No. 2 containing the 2 percent starch now has most of the starch settled in the bottom.

Q. Has the starch settled in the bottom there?

Tr. 95 A. Yes.

Mr. Bruninga: Can you see it, Your Honor, that it is settled in the bottom, some of the starch?

The Court: Oh yes.

By Mr. Bruninga: Q. Now, add the same amount of caustic to that that you added to the quaebracho and see what happens then. A. I will add 7 of these pellets, or 1 gram of sodium hydroxide to Bottle No. 2. It will take a little while for the caustic soda to dissolve. I will shake them both together. The caustic soda is all dissolved in bottle No. 3. That now contains 2 percent tannic acid or quaebracho and 2 percent caustic soda. It is a dark solution.

Q. Still a solution, is it? A. Yes, it is a solution. The caustic is not quite all dissolved in bottle No. 2 containing the 2 percent starch but there is enough of it dissolved so that the pH of the system is above that required for gelatinizing the starch, and the starch is now hydrolyzed, gelatinized.

Q. You took the very example Mr. Cannon gave in his patent, you took caustic 2 percent and you took quaebracho 2 percent, didn't you? A. Yes.

Q. You got a solution, didn't you? A. Yes, I have a solution that Cannon discusses.

Tr. 96 Q. The Examiner says you can substitute starch for a quaebracho over there and get Cannon's result. We want to see what we will get.

What do you get, a solution or something else? A. If starch is substituted for tannic acid or quaebracho in the Cannon formula, you will get a very viscous suspension of gelatinized starch.

Q. That is a gel, isn't it? A. Yes.

Q. In other words, you have a caustic plus quaebracho, which is a solution and caustic plus starch is a gel? A. That is right.

Q. Is caustic or quaebracho a substitute for bentonite? A. No.

Q. What does bentonite do? A. Bentonite is the source of a clay colloid for drilling bud, whereas caustic and quaebracho are mud treating chemicals for the purpose of reducing the viscosity of the gels that are in muds.

Q. Is starch a substitute for bentonite? A. Yes, starch can be substituted for bentonite and will be in the colloids as an organic colloid.

Q. Cannon talks about taking 10 percent bentonite, and you say up to 20 percent. Have you prepared 10 percent bentonite, and have you tried caustic quaebracho
Tr. 97 on one and caustic starch on the other, and see
what happened? A. That is jar No. 1 and 1-A.

Q. Have you put anything in—you have shaken that up better. Show the Judge just about what its fluidity is when they have been standing there for a little while. A. They are quite thick. Would you like me to pour them from one to the other?

Q. Pour one into the other so that you get it uniform for both of them, and then pour it back, one into the other, again. But I want you to show the Court just what you have there as far as consistency is concerned, the viscosity. A. This is a viscous suspension in bentonite and is perhaps more viscous than can be used as a drilling mud except for special purposes.

Q. Go ahead and add the caustic quaebracho to one and see what you get. The preparation is caustic quaebracho that you have? That is right? A. I pour about 1 to 2 cc of the 2 percent caustic quaebracho mix into bottle 1, shake it, and it has caused a reduction in viscosity.

Q. Hand it to the Judge, so he can see.

The Court: I can see.

Mr. Bruninga: You can see that, can't you?

The Court: I can see it. I have got a good light there.

Tr. 98 By Mr. Bruninga: Q. Try to do the same thing with what the Examiner says Cannon can do, just substitute starch for the quaebracho. A. Jar No. 2, containing the gelatinized starch, 2 percent caustic. I will pour in about 1 to 2 cc. It turns to a——

Q. Let the Court look right at the middle of the bottle. In other words, the caustic quaebracho thins the mud and the caustic starch will thicken it? A. That is correct.

Q. What did Cannon want to do, thicken his mud, to use a caustic quaebracho, or thin it? A. No, Cannon wants to thin his mud when he used caustic quaebracho.

Q. If he didn't do that, taking from 10 to 20 percent bentonite, could he work at all with it? A. Not unless he put in the caustic quaebracho in such quantities, the 10 to 30 percent bentonite would result in a paste.

Q. Can you, then, say that starch is a substitute for quaebracho, used with caustic soda? A. No, it is not a substitute. It is just the opposite.

Q. Do you know anything that could be on the opposite ends of a scale worse than trying to put starch on Tr. 99 one end and quaebracho on the other? A. No. It had just the opposite effect. Starch has the opposite effect of quaebracho.

Q. Mr. Cannon does not say a word about using gelatinized starch? A. What?

Q. Does Cannon say whether he used gelatinized starch when he refers to starch there on page 2? A. No. His one mention is the word "starch."

Q. And if he had used gelatinized starch—if he had used plain starch, what would have happened, from what you know about starch? A. If he had used starch in this concentration, it would have gelatinized.

Q. And would it reduce the viscosity? A. It would have increased the viscosity of the mud, rather than thin it, just as I have shown here.

Q. Mr. Larsen performed some experiments which are supposed to have paralleled what is disclosed in the Cannon patent, with the substitution of starch for quaebracho, that is PX-6.

Your Honor, you have it there. It is Plaintiff's Exhibit 6.

The Court: Yes.

Tr. 100 By Mr. Bruninga: Q. Now, take that first one, where you used 1 gram of caustic, or the one where you used 2 grams of caustic, it doesn't make any difference, and where you use caustic with quaebracho in A, B, C, and D. They all worked, didn't they? A. Yes, these muds made up represented as A, B, C, and D would be within a usable viscosity range.

Q. How about D? That is a little bit high, isn't it? A. The mud has a 200 centipoise viscosity. That is pretty close to the upper range.

Q. But A, B, and C worked all right? A. They are within a useful viscosity range.

Tr. 101 Q. Mr. Larsen took A, B, C, and D and paralleled it by a, b, c, and d, and substituted starch for caustic. Do any of those drilling fluids work? A. No, the viscosities are too high to measure on the Stormer instrument, and any mud that has a viscosity that high could not be pumped.

Q. One of those experiments you performed shows what happened, doesn't it? A. Yes.

Q. Proceeding with this, Mr. Cannon gives his caustic as one-third of 1 percent by weight of drilling fluid, and the Board of Appeals says that the proportions he uses are many times what was used before. You said a little while ago that what Lawton and Loomis had was one-fifth of 1 percent? A. Yes.

Q. One-fifth of 1 percent, and the Board talks about 50 to 100 times. One-third, as a matter of plain arithmetic, one-third and one-fifth are pretty close, aren't they? A. That is correct.

Q. Here is one thing I want to call attention to.

He gives as a yard stick one-third of 1 percent of the weight of the drilling fluid, which is .33. Mr. Larsen has conducted an experiment in which he simply combined
what he said was known by the literature, and
Tr. 102 that is PX-4, in which with caustic soda even at
.5 percent there was no gelatinization, and Mr.
Larsen also stated from the literature, two very high class men, one of them Oswald—by the way, it is correct, as Larsen says, isn't it, that Dr. Oswald is known as the father of colloid physics of chemistry? A. Yes, he is referred to as such.

Q. Dr. Oswald runs the percentage up to .6, the other one makes it .55. Mr. Larsen found you had to go above .5 in order to get gelatinization. When Mr. Cannon told the art you had to use one-third of 1 percent, or, say, in excess of one-third of 1 percent, your .60 is almost twice that, isn't it? A. Yes.

Q. Taking that as a guide, one skilled in the art, as a guide for making up a drilling fluid containing caustic and quaebracho with bentonite, that was all right, wasn't it? A. That is right.

Q. That was all right? A. Yes.

Q. Suppose that was given you as a guide for making up drilling fluid. Could you select a starch? What would you need? A. One-third of 1 percent, say, of caustic soda is not enough to cause the starch to gelatinize.

Q. In other words, even if we take the examiner's
Tr. 103 idea of using, say, one-third of 1 percent and
starch, by that you wouldn't get gelatinization,
would you? A. No, you wouldn't get gelatinization.

Q. You would have to go up to almost twice that amount, wouldn't you? A. Yes.

Q. Using Cannon's guide book as in excess of one-third of 1 percent, which is repeated five times, in each of the claims, that wouldn't be made possible, would it? A. No, that wouldn't.

Q. The Examiner has to go further, now, and say because Cannon says he can substitute lime for caustic soda, and substitute any one of those examples, and use lime instead of caustic soda. What do you get, gelatinized starch? A. No. No, not gelatinized starch as I have here using calcium hydroxide of lime.

Q. Mr. Larsen also testified on Exhibit PX-4 he conducted those experiments, that you couldn't get a gelatinization. In other words, as far as caustic is concerned, as far as quaebracho is concerned, that is all right, isn't it? Cannon is perfectly O. K. on that, isn't he? A. Yes.

Q. But as soon as you substitute starch for quaebracho, do you get what Cannon wants? A. No, you get into trouble.

Tr. 104 Q. Get in trouble right away, don't you? A. Yes.

Q. In other words, it is correct to say it would defeat the very thing Cannon wanted to do? A. That is right.

Q. Now, I want to just call attention to just one more thing, and then I think I am through.

Are you familiar with the Chapman patent, 2,399,986? Have you got it there? A. Yes, I have got it.

Mr. Bruninga: I would like to offer that, Your Honor, as PX-14.

Mr. Miller: No objection.

The Court: It may be received.

(The patent referred to was marked Plaintiff's Exhibit No. 14 and received in evidence.)

By Mr. Bruninga: Q. You know Thomas S. Chapman, don't you? A. Oh, yes.

Q. He is the same man who was with Gray and Foster on that paper of February, 1941, PX-7? A. Yes. He was one of the authors of that paper.

Q. You take that patent right there. You have read it.

And, make it short. How does that compare with Tr. 105 the disclosures in that paper, that patent? A. It is on the same subject matter.

Q. What it actually claims is, for instance, in Claim 8, is a salt water drilling fluid containing a filtration reducing amount of gelatinized starchy material.

Now, as far as I am concerned, we have already gone through the paper. What he does there is to gelatinize the starch. He makes this statement in this patent, page 1, left, near the bottom, that according to the present invention water loss by filtration from drilling mud is reduced to a minimum by the addition to the drilling mud of a gelatinized starch or starch-containing material, that untreated starch serves no useful purpose in diminution of water loss, that when, however, the starch is subjected to a treatment suitable for the gelatinization thereof, it exhibits a very remarkable quality for preventing filtration of water into porous formations that it traverses.

You agree with that statement? A. That is a correct statement?

Q. He continues that methods of gelatinizing starch are well known in the art. Now, then, he talks about a procedure which is the same as in this publication, isn't it? A. That is right.

Q. Then he gives a specific thing, that in connection with the gelatinization of starch with caustic, it Tr. 106 is the practice to use the starch and caustic in a weight-ratio of about 10 to 1. That is, again, what is said in that paper, isn't that right? A. That appears in the AIME, yes.

Q. Is that different or the same as in the Stern publication? A. The same ratios, also, are used by Stern.

Mr. Bruninga: Your Honor, on page 3 you will see while the application on page 1 was filed July 9, 1945, it is a continuation of an application of July 1, 1940, so that is the effective date of that application. We are deliberately putting in prior art, Your Honor, that the Commissioner has missed, like I did in a number of cases.

Now, the patent was assigned to the Standard Oil Development Company, the very same company to which the Cannon patent, 2,109,858 was assigned. I want to note that, Your Honor. You know that Standard Oil Development Company is simply a patent subsidiary of Standard Oil Company of New Jersey, is it?

The Witness: Yes, I know that.

By Mr. Bruninga: Q. Patent holding subsidiary, and that the Humble Oil & Refining Company is a subsidiary of Standard Oil Company of New Jersey? A. Yes.

Tr. 107 Q. That is well known, isn't it? A. Yes.

Mr. Bruninga: That patentee, Chapman, and, by the way, Your Honor, the original application was filed in the name of all three of those fellows, and then later on they found Chapman should be the inventor. He refers specifically to the Cannon patent.

"The use of gelatinous starch prepared by treating with caustic according to the present invention is not to be confused with the use of starch as a protective colloid in connection with drilling muds containing a high concentration of alkaline, for example, as Patent 2,019,858, a drilling fluid for heaving shale—"

That is the Cannon patent.

"The characteristic feature which is stated in the maintenance of a high alkalinity by having caustic alkali present in the mud in the amount equal to one-third of 1 percent by weight based on the total weight of the drilling mud."

"It is to be understood this percentage is the minimum."

"It was found with such percentages of alkali in the conventional drilling mud that solid constituents of the mud tended to be flocculated so that mud of undesirable consistency results. To avoid this flocculation the patentee proposed to add a protective colloid in the mixture and indicated this protective colloid should be in Tr. 108 an amount equal by weight with the caustic. According to the patent lesser amounts of protective colloid could be used as long as the amount used was sufficient to prevent flocculation. For instance, in one specific composition the patentee specified 2 percent by weight of colloid and 7 percent by weight of caustic. Among the protective colloids listed by the patentee was starch. If starch is used in connection with caustic in the amount proposed according to the present invention in the proportion of 2 percent by weight to 7 percent by weight it not only does not retard water loss by filtration, but actually has an adverse effect.''

''In the present invention caustic enters the final drilling fluid only incidentally in such amounts as are necessary to gelatinize the starch, this amount being generally on the order of one-tenth of 1 percent of the weight of the starch.''

Tr. 109 The Court: I think we will suspend for a short recess.

(A short recess was taken.)

By Mr. Bruninga: Q. Now, the application of Chapman patent 2,399,986, the patent itself was filed on July 9, 1945. What is used there to prevent fermentation of the starch? A. The thing that prevents fermentation in the Chapman patent is the concentration of salt in the mud. I don't know whether he has any mention of that or not.

Q. But that is what he actually discloses in the claims, and that will do the work, won't it, the concentration of salt? A. There is no mention in here of anything to prevent fermentation other than the salt concentration in the mud.

Q. The salt concentration in the mud will prevent fermentation? A. Yes, if it approaching saturation, or 23 percent salt.

Q. And the Gray, Chapman and Foster paper also used the concentration of salt sufficient to prevent fermentation? A. Yes.

Q. Do you find any statement whatsoever in the Cannon patent 2,109,858 of the pH that he wants to get? A. No, I don't see any mention of pH as such.

Q. But he will get a pH of 12 where he uses that Tr. 110 high concentration of caustic, will he not? A. Yes, the pH of the Cannon mud is above 12.

Q. Now, in the specification in suit—PX. 1—take my copy here—I will take the other copy—on page 3 it is stated as amended "A form of starch which is a colloid of the character described is a pre-gelatinized starch prepared by cooking the starch with water and drying it; it may then be comminuted for addition to the drilling fluid in dry form; an example is cold water laundry starch which gelatinizes in cold water. Thin boiling starch (prepared, for example, by mineral acid treatment) gelatinized by cooking with water, is useful for this purpose."

He had previously referred to gelatinized starch with caustic, or such starches or colloids of the character described, and, more specifically, amylaceous or starchy colloids. Is raw starch a starchy colloid? A. No.

Q. The reason I am asking is that in the claims, the application is a starchy colloid? What does that mean to you? A. That means a gelatinized starch.

Q. It is a matter of the way it is accomplished, whether by caustic soda or something else, is that right? A. That is right.

* * * * * * * *

Tr. 112

Cross-Examination,

By Mr. Miller:

Q. You testified, did you not, your company sold gelatinized starch in 1941? A. Yes.

Q. Now, you have talked a great deal about gelatinized starch, hydrolized starch, colloidal starch and pasted starch. Are they essentially all the same thing, in general? A. Yes, they are about the—they are all the same.

Q. Now, this gelatinized starch which your company sold in 1941, what was it used for? A. It was used as the organic colloid in drilling muds.

Q. There wasn't any problem, then, was there, as to how much starch to use to obtain the desired result of sealing the wall, and low water loss? A. Yes. There was a problem with common starch, corn starch.

Q. I mean this gelatinized starch that you sold, they knew how much to put in, didn't they, to get the Tr. 113 result they wanted? A. Yes, they knew how much to put in.

Q. And it was perfectly satisfactory in salt water if the concentration was up about 23 percent salt, was it? A. Yes, if the concentration was up approaching saturation.

Q. And if you could complete your well in four or five days, there was no trouble from fermentation, was there? A. That is right, if you could do it that fast.

Q. And you testified that you heard about the discovery of alkalizing to a pH of 12, but you didn't state when you heard about this. Will you tell the Court when it was you heard about this discovery of alkalizing to a pH of 12? A. For the purpose of preventing fermentation?

Q. For the purpose of preventing fermentation in this gelatinized starch used in well drilling. A. I believe that was late in 1942.

Q. Have you read the deposition of Jack Beesley and Delmar Larsen? A. Yes.

Q. Which have been taken for the court. Are you familiar with the history of the work of Jack Beesley? A. History of his work?

Q. Yes. A. Yes, I am.

Q. Larsen testified at page 63 of these deposi- Tr. 114 tions that they were still struggling with the problem of fermentation in 1941, but I note that Jack H. Beesley, who is one of the applicants in the application here in suit, on page 11 of the depositions says that gelatinized starch with a pH of about 12 in the drilling fluid was used in 1941. Can you harmonize those two statements? A. I believe I can. I don't think that Beesley publicized the findings and his information too rapidly. He did this work, I found out later, while the fermentation was giving me quite a bit of trouble.

Q. Now, let us look at the patents to Cannon. Did I understand you to say that on the disclosures of the portions of alkali there set forth that the alkalinity of the drilling fluids disclosed by Cannon will be above 12? A. Yes. This 2 percent caustic is above 12 pH.

Q. And you have been talking a great deal about quaebracho extract in combination with alkali, but have you read Claim 1 of the Cannon patent? A. Yes.

Q. That is a claim, is it not, which really is a claim for a whole lot of different combinations, that is, it may be a claim for a combination of tannic extract and alkali, it may be a claim for a combination of humic acid and alkali, or pyrogallic acid. In other words, it is not only one thing. It is an organic compound which we take Tr. 115 out of this long list, do we not? A. That is correct.

Q. In that list one of them is starch? A. Yes. I see starch here.

Q. Now, you mentioned that starch which is not gelatinized if put in water is inert, and does not gelatinize, is that correct? A. Yes.

Q. But you admitted, did you not, if there is enough alkali in the water, that will gelatinize the starch, did you not? A. Yes.

Q. How much alkali does it take to make the starch become gelatinized? A. How much?

Q. How much alkali by percentage? A. It will be about .6 of a percent by weight.

Q. Then if you use as much as 1 percent caustic soda, which Cannon mentions on page 2, then the starch will of necessity gelatinize, will it not, because there is that much caustic soda present with it? A. Yes, it would gelatinize at 1 percent caustic.

Mr. Miller: That is all, Mr. Farnum.

Redirect Examination,

By Mr. Bruninga:

Q. Just a very few questions. You were asked Tr. 116 about Larsen's statement of struggling in 1942, and Beesley's statement he had tried late in 1941. Beesley was located in Illinois, was he not? A. He was in Illinois in 1941.

Q. Where was Larsen? A. He was in California.

Q. And where, from what office was Beesley working? A. He reported to the Tulsa, Oklahoma, office.

Q. With Sikes, is that right? A. Sikes was the manager.

Q. As far as 1941, that Beesley talked about where he said he used lime, and you read the deposition, to obtain a pH, that didn't go into commercial use right away? A. No, we struggled pretty hard to build the total sales up to where it was an accepted procedure.

Q. You had a laboratory in Tulsa at that time, didn't you? A. Yes, there was a laboratory in Tulsa.

Q. And Larsen was in charge of the laboratory in Tulsa? A. Yes, Larsen was in charge of the laboratory in Tulsa.

Q. As far as the Baroid Sales organization is concerned, when you find anything new, do you throw it on the market right away, or conduct a lot of laboratory ex- Tr. 117 periments? A. No, we try to prove it first in the laboratory, and then on single wells, so that when we offer it generally we will have a good background of information on it.

Q. Now, as far as using starch in plain drilling fluid, without any salt at all, and if there are no bugs got into it, that would work O. K., wouldn't it, gelatinized starch? A. Yes, but you can't say there will be no bugs get in it.

Q. What I mean by bugs is the bacteria or enzymes, that is right, isn't it? A. That is right.

Q. As far as the amount of starch you use, that is a matter of determining the collodial properties of the starch as an emulsoid colloid, and you use so much to get a certain amount of filter action? A. Yes, you use enough to get your objective.

Q. In your filter tests you made in your laboratory you did not have any policy about using any pH at all, did you? A. No.

Q. But when starch was used in salt water, no bacteria or enzymes caused fermentation? A. That is correct.

Q. And that is what the Chapman paper speaks about? A. That is right.

Tr. 118 Q. That was the Gray, Chapman and Foster paper? A. Yes.

Q. When you didn't have the salt available and fermentation started, what happened to the starch? A. The starch was destroyed by the yeast that causes fermentation.

Q. It was not simply a problem of having a certain percentage of starch to give you a certain amount of water loss, but also maintaining that starch in that condition, isn't that right? A. That is right.

Q. And that was obtained by the pH of 12, isn't that right? A. Yes. We stopped the fermentation by building the pH to 12.

Q. Mr. Miller tried—I believe he tried to almost say you picked out Cannon out of this long list of examples and dwelt on that. Did you find any example by Cannon at all except quaebracho? A. No. All Cannon's examples use quaebracho extract.

Q. Did you find any examples at all with starch? A. No.

Q. All the rest of them except starch and sugar; I think you said they were all related to quaebracho or tannic, humic, pyrogallic acid, and so forth, isn't that right? A. Yes, those are all tan stuffs.

Tr. 119 Q. Mr. Miller also carefully directed your attention to the fact that in those examples using 1 percent of caustic soda that it gelatinized, is that right? A. Yes.

Q. But Cannon five times, as I said before, called attention to one-third of 1 percent. You said that wouldn't gelatinize it at all? A. That is right.

Q. Suppose you followed Mr. Cannon's example he gives there, of one-third of 1 percent, use a quaebracho, use a bentonite, with it or without it, would that starch gel? A. No, it would not.

Q. So Cannon's signpost wouldn't help you there, would it? A. No.

Q. You would have to multiply it by two? A. Yes.

Q. If you went further and like Cannon says there used instead of caustic soda lime with starch, you don't get anywhere? A. No, lime won't gelatinize the starch.

Q. In that claim that I called your attention to, counsel called your attention to a bunch of agents that were listed, but he did not note that the claim itself specifies at least one-third of one percent of caustic. That would
Tr. 120 not cause gelatinization of starch, would it? A. No, it would not.

Q. But it would work with any of the Cannon's? A. If the Cannon's were used here, Cannon would end up with his drilling fluid he is after, one that will not pickle the heaving shale.

Q. Counsel did not read the part where it says "At least one-third of 1 percent by weight based on the total weight of the drilling fluid, and colloidal material in sufficient quantity to substantially prevent the alkali and organic compound from precipitating the clay and functioning to take up and hold any replaceable water in the mud and substantially prevent hydration of the shale by the water of the drilling mud."

That is what Cannon used 10 to 30 percent bentonite for, did he? A. That is right.

Q. I think you said if he used caustic and quaebracho in those amounts, he could get his drilling fluid down in thickness as Mr. Larsen stated? A. That is right.

Q. And as you show in your demonstration? A. That is right.

Q. But if you tried that sort of a thing, substituted for quaebracho extract or any of the other tannins, Tr. 121 starch, you get what? A. You would get just the opposite, a thickening effect of the mud.

Recross-Examination,

By Mr. Miller:

Q. The patent of Cannon says on page 2, in the second column beginning about line 11 that the portion of caustic soda, and these other things, may be varied over wide ranges. He says that, doesn't he? A. Yes.

Defendant's Exhibits A, B, C, D, E, F, G and H were offered.

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Tr. 134

Further Direct Examination,

By Mr. Bruninga:

Q. Mr. Farnum, you read the deposition of Mr. Larsen, of course, because I told you to, so you could be cross-examined on it? A. Yes.

Q. By the Commissioner's counsel, is that right? A. Yes, sir.

Q. Mr. Larsen says he observed that in some of these tests the filter was darker in color showing that perhaps the starch had been caramelized by the high alka- Tr. 135 linity. Now, are you familiar with that phenomena, what happens if you use too high pH or use too much caustic? A. Yes, I am.

Q. What happens? A. As he states, the starch will caramelize, which means carrying the decomposition or the hydration of the starch too far, carries it down to the sugars and actually synthesizes it, a new combination is formed, quite a bit as you do when you burn sugar on a heated pan.

Q. Is starch any good when it is caramelized like that? A. No, the caramelization produces compounds that in no way help to reduce the filter loss of a drilling mud, in fact produces compounds that are virtually water soluble and go to the filter.

Q. How does that compare with molasses, or, say, Karo corn syrup? A. Well, corn syrup is made from corn starch by carrying your hydrolysis almost to the end point, breaking the starch down to the very simple sugars that are 100 percent soluble, and this caramelization process is, say, mid-way between this first step in gelatinization and the production of the simple sugars.

Q. But as far as using a real high pH in connection with quaebracho, does that do any harm? A. No, extreme alkalinity has no harmful effect upon
Tr. 136 quaebracho or its use as a drilling mud.

Q. Tannin plus alkaline? A. Yes, excess caustic will be present as sodium hydroxide in the mud.

Q. Summarized as to Cannon, the situation is this, is it not, as long as you stick to quaebracho or one of the tannins with the one-third of 1 percent, you are o. k., you carry the pH just as high with quaebracho as you want to, but then what it comes to starch, one-third of 1 percent will not cause gelatinization of this starch, and if you carry the pH too high, you are liable to get caramelization? A. That is correct.

Mr. Bruninga: That is all. Thank you.

Cross-Examination,

By Mr. Miller:

Q. Mr. Farnum, where is the value of the pH where the caramelization of starch sets in? A. Where does it?

Q. Yes. A. It would probably start about 13.2 or 13.3. The time factor also comes in there.

Q. Isn't it a fact in the application in suit here it says the pH can be as high as 13.3 without any harmful results? A. I don't know whether it does or not.

Tr. 137 Q. We will look and see. You have read the specification, have you not? A. Yes, I have.

Mr. Bruninga: Let us find it. I know there is a statement in there but it isn't just what you say it is.

Mr. Miller: Page 7 of the specification.

The Witness: 87?

Mr. Miller: 7.

The Court: Page 7.

Mr. Miller: The second paragraph, down to line No. 22 says:

> "The pH may be slightly below 12, thus a pH of 11.7 is in many cases sufficient."

Then it says:

> "The pH may also be about 12."

Then the sentence after that, beginning at line 26, does it not read this way:

> "We have, however, found that generally the pH should not be above 13.3."

That is there isn't it?

The Witness: Yes, I read that.

By Mr. Miller: Q. And that did disclose the pH could be as high as 13.3?

Mr. Bruninga: Read the rest.

Tr. 138 The Court: Wait. He has the witness.

Mr. Bruninga: All right. Thank you.

The Court: Answer Mr. Miller's question. Do you understand the question?

The Witness: No, sir.

The Court: Repeat it, please.

By Mr. Miller: Q. In line 26, "We have, however, found that generally the pH should not be above 13.3." It says that, doesn't it? A. Yes, I read that here.

Q. And then after that it says this, doesn't it: "because it appears that above that point the starch tends to begin to become less effective"? A. That is right.

Q. It doesn't say it won't work above that, it just says it is not so effective? A. That is right.

Q. Above 13.3, but it is all right up to a pH of 13.3? A. That is right.

Mr. Miller: That is all.

Redirect Examination,

By Mr. Bruninga:

Q. What did you give, 13.2, as being the point where it is liable to caramelize?

The Court: Wait a minute. That is a leading question.

Tr. 139 By Mr. Bruninga: Q. What did you give as the point at which a starch begins to caramelize? A. As I remember my response, I said starch would begin to caramelize at a pH of about 13.2 or 13.3.

Q. And the statement here is:

> "We have, however, found that generally the pH should not be above 13.3 because it appears that above that point the starch tends to become less effective."

The Court: Isn't that just what Mr. Miller read?

Mr. Bruninga: Yes.

By Mr. Bruninga: Q. What do you understand is meant by that? A. I understand that at approximately 13.3 pH and higher the starch will begin to caramelize and will be less effective as a colloid to add to drilling mud. That caramelization is something that doesn't happen instantly. There is a time factor in there and starch can be used even though caramelization begins. You have lost that amount which has caramelized. It doesn't change black to white at any one specific point.

Q. Well, in the tests numbered C and D of Cannon on what we call our PX-6 of Mr. Larsen's tests he states in those two tests the caustic was 13.40 and 13.72, Tr. 140 and the same way with starch, when starch was used it was 13.20 and 13.24, 13.61 and 13.53. Is that just a matter of quibbling, between 13.3 and 13.5? Is that just a small difference? Is the difference between a pH of 13.6 and 13.3 a small difference? A. No, that is a fairly large difference, I would say. Three-tenths of a pH at that range would be, say, the difference between 6 percent and 12 percent caustic.

Q. The one I gave you of 13.6 was 7 grams of caustic and 61 cubic centimeters, as Cannon gives it, which is 13.61. That scale, that pH scale, I think you said it was a logarithmic scale? A. Yes, that is right.

Q. What do you mean by that? A. That means it goes up not as a direct function of the numbers there, but as a power function. From pH 9 to pH 10 or from 11 to 12 is 100 times. It goes up as a power function. That is why it is an accurate scale. At the low pH's, say, pH 7 to pH 10, it is a most accurate method of measuring, but when you get up to the pH 13 to 14, it is better to put it in percent by weight of caustic.

Q. When Mr. Larsen found 13.6 or 13.3 with starch apparently was caramelized, was the pH too high or too low? A. Well, at 13.6 is too high. It will cause caramelization of the starch.

Tr. 141 Q. And 13.3, how about that? A. 13.3 is about on the borderline, given time, elevated temperatures, it will begin to caramelize, and the starch will be lost from the system in that way.

Mr. Bruninga: Your Honor, what we used in the claims was a pH of about 12.

There was no oral argument and briefs by both parties were required to be filed in one week.

* * * * * * *

Dp. 1 Depositions of JACK H. BEESLEY and DELMAR H. LARSEN taken on behalf of plaintiff, pursuant to attached notice, before Lois McMullin, a Notary Public, at the offices of Bruninga and Sutherland, Suite 302 at 1004 Market Street, St. Louis, Missouri, commencing on the 15th day of June, 1950, at 1:00 o'clock p. m. and continued to and resumed at 10:00 o'clock a. m., June 16, 1950, at the same place, until completed, on the part of the plaintiff.

Appearances:

John H. Bruninga, Esq., for plaintiff.

No appearance for defendant.

Dp. 2 JACK H. BEESLEY,

of lawful age, being produced, sworn and examined on behalf of plaintiff, deposes and says:

Direct Examination,

By Mr. Bruninga:

Q. What is your name? A. Jack H. Beesley.

Q. Where do you live? A. Tulsa, Oklahoma.

Q. What is your business? A. Division Sales Manager for the Baroid Sales Division of National Lead Company.

Q. How old are you? A. Forty.

Q. What has been your education, oh, just generally? A. Regular education, two years of college, University of Michigan.

Q. What did you do after you left college? A. Worked for the Standard Oil Company of Indiana.

Q. Doing what? A. Warehouse.

Q. Did you get out in the field work at all? A. No, that was domestic sales.

Dp. 3 Q. When did you first get out on field work? A. 1937.

Q. What kind of work was that? A. You are talking about oil field work?

Q. Yes. A. That was roughnecking.

Q. A "roughneck" really is an apprentice, isn't he? A. He is a laborer on a drilling rig.

Q. Where was that? A. Corpus Christi, Texas.

Q. And that was on a rig drilling an oil or gas well? A. Drilling for oil.

Q. How long did you stay on that job? A. I was on that work for five months.

Q. What did you do then? A. Went to work for George S. Mepham Corporation, service engineer.

Q. What was Mepham selling? A. Were selling Colox.

Q. Colox was what? A. Comparable to Baroid.

Q. But Colox was finely ground iron oxide? A. That is right.

Dp. 4 Q. And Baroid was finely ground barites? A. Yes.

Q. And that was used as mud weighting material? A. Yes.

Q. Now, how long did you stay with Mepham? A. Two and one-half years.

Q. And where did you go then? A. Baroid.

Q. By the way, where did you work for Mepham as sales engineer? A. I worked for them in Oklahoma City, Lake Charles, Louisiana, New Orleans, and in Illinois.

Q. What was the work of sales engineer, what was the nature of your work? A. Was to analyze the mud in different drilling wells and to make recommendations for better use of the mud to keep running wells out of trouble and overcome trouble that had already occurred.

Q. Did not Mepham sell a phosphate at that time? A. They did.

Q. What was that phosphate used for? A. Thinning muds.

Dp. 5 Q. Now, what you did in your job as sales manager was really to call on the people at the wells to see what they needed, isn't that right? A. That is right; influence them in the use of materials and to help them overcome difficulties in drilling wells.

Q. But the actual stuff was sold by distributors of Mepham, wasn't it? A. That is right.

Q. Now, you came to Baroid, I believe you said, in 1939? Same kind of a job? A. Same kind of capacity.

Q. And Baroid at that time was selling Baroid, it was ground barites also? A. Yes.

Q. And Aquagel, which is Wyoming Bentonite? A. Yes.

Q. And that was also added to the drilling mud? A. Yes.

Q. Now, Baroid Sales was also selling Stabilite at that time, which was a phosphate? A. That is right.

Q. Now, the Baroid was used to weight down the mud, isn't that right? A. We call it weighting it up. I guess weighting it down would be proper also.

Dp. 6 Q. And Aquagel was used at that time to add to the colloidal properties? A. Increase the viscosity.

Q. Increase the viscosity of mud, and Stabilite was used to—— A. Reduce the viscosity.

Q. Now, you need all those three, don't you, in most areas? A. That is right.

Q. And you went out in the field the same way to see what was needed? A. That is right.

Q. Now, how did you measure the viscosity, what kind of instrument did you use? A. Marsch funnel and sometimes a Stormer.

Q. Now, the funnel, the Marsch funnel, was just a funnel that you poured your mud fluid in and let the mud run out and you timed how many seconds it took to make a certain amount? A. That is right.

Q. And that was given in seconds, was it not? A. Given in seconds.

Q. But the Stormer gave in what is known as centipoises? A. That is right.

Dp. 7 Q. And you also used the Stormer to give the gel strength, didn't you? A. That is right.

Q. That is, to gel the mud fluid. Now, a mud fluid is a pretty ticklish thing to handle, isn't it, to keep it in control? A. That is right.

Q. What happens if you don't keep it in control? A. The tool may become stuck, or something else happen to keep you from completing the hole or making as much time on it as is required.

Q. What fields did you cover for Baroid Sales? A. Indiana, Michigan, Kansas and Colorado, Illinois and Kentucky.

Q. Now, your job is division sales manager, do you have a lot of these technical men like you under you? A. Yes. Not under me, we have them with the company, they are under the field division superintendent.

Q. But you rose to that point where you became division sales manager? A. That is right.

Q. Now, you are the Jack H. Beesley who is the applicant, who filed the application, or rather, signed the application, with D. A. Sikes, serial 489,890, and which is involved in this suit, isn't that right? A. That is right.

Dp. 8 Q. Now, do you know what water loss is? A. Water loss is the amount of fluid, water pressed from mud under 100 pounds pressure.

Q. Now, in the drilling of this well the mud fluid goes down the drill pipe, comes out at the bottom and rises on the outside and carries the cuttings with it, the cuttings are deposited in a ditch or taken out by a screen, then run over to a sump or tank? A. That is right.

Q. Now, that drilling mud has got water in it, hasn't it? A. That is right.

Q. And that can go down and go into the formation, that is right, isn't it? A. Yes.

Q. Now, suppose you struck a producing formation for gas or oil and a lot of water gets into that formation, what happens? A. They retard the production of oil or gas from that formation.

Q. In other words, you have got a lot of water in that formation that you have to get out some time later on? A. Also water goes in to the formation of high porosity,

which would allow mud to be built upon the side
Dp. 9 of the wall, thus making it hard, or impossible
to withdraw drilling tools from the well.

Q. Now, the idea is to keep as little water from going into that producing formation as possible, isn't that right? A. That is right.

Q. You have a way of measuring that, don't you, above the ground, what the water loss will be? A. Yes, we have a Baroid filter press.

Q. It is a tester that tells you in cubic centimeters in a certain length of time, isn't it? A. That is right.

Q. And say 5 c. c. or 5 cubic centimeters means a water loss of 5 c. c., isn't that right? A. Yes.

Q. And 20 means 20, and it is desirable to keep that water loss down? A. It is.

Q. Now, how about use of clays in that respect? A. Ordinary clays would not reduce it very much.

Q. How is Bentonite? A. Bentonite reduces it much farther.

Q. Supposing you strike a salt water, what happens then? A. The Bentonite does not give you a low water loss.

Dp. 10 Q. Now then, you have sold Zeogel, what is that? A. Fuller's earth.

Q. That is recommended for salt water? A. For building viscosity in salt water.

Q. How about the water loss? A. The water loss is very high.

Q. Now, this case involves the use of starch in drilling mud and more particularly at a high p. H. of about 12. Now, do you know what Imperex is? A. It is a starch, a hydrolized or gelatinized starch.

Q. It is not a raw starch like corn starch, is it? A. No.

Q. The Baroid Sales sells that? A. Yes.

Q. Do you remember what year it was first sold? A. Came out in 1941.

Q. Did you sell any of it? A. Yes, I did.

Q. Did you service any of it? A. I did.

Q. How was the starch, for instance in a tester, as far as water loss is concerned, a tester above the Dp. 11 ground, does it give a low water loss? A. You mean the starch by itself?

Q. I mean a gelatinized starch when you first start it. A. Yes.

Q. What happens to it when you have starch in a well? A. It ferments or otherwise deteriorates.

Q. What happens to the water loss? A. Which increases the water loss and increases the viscosity of the drilling fluid.

Q. Did you try anything to stop that sort of fermentation? A. Yes, tried creosote.

Q. What did that do? A. That didn't arrest the fermentation.

Q. It didn't kill the "bugs" in there? A. That is right.

Q. Now, we are talking now about your high p. H. of 12, using a gelatinized starch or starchy colloid at a p. H. of about 12 in drilling a well to get you a low water loss. Do you remember when you started doing that? A. It was in 1941.

Q. Now then, what did you use to get that p. H. in the first place? A. Used lime.

Dp. 12 Q. What kind of lime? A. Just hydrated lime.

Q. How did it work? A. Worked very well; arrested the fermentation of the starch and allowed the well to be completed without trouble.

Q. About what p. H. did you carry? A. Maintained the p. H. at 12.

Q. And it worked at that? A. Worked at 12.

Q. What did it do to the water loss? A. Reduced the water loss and kept it there, maintained the water loss.

Q. At a lower point? A. Yes.

Q. Lower point than Aquagel? A. Yes.

Q. But it stopped the fermentation, didn't it? A. That is right.

Q. Was anything used outside of lime after that? A. Yes, we used Aquagel after that to increase the viscosity.

Q. Did you use anything instead of lime to give a high p. H.? A. No.

Dp. 13 Q. I mean, after that? A. After that we used caustic soda.

Q. Now, do you use lime now? A. Some lime is used, but caustic soda is also used.

Q. But lime is used with Impermex, isn't it? A. Yes.

Q. And caustic soda is used with Impermex to give you a p. H. of 12? A. Yes.

Q. And where lime is used it is called lime Impermex system, isn't it? A. Yes.

Q. It works, doesn't it? A. It works very well.

Q. Do you use starch only in drilling a well? A. No.

Q. What do you use? A. We use some clay that is made in the hole and use Bentonite or Aquagel.

Q. When you use Bentonite or Aquagel about what proportion do you use? A. About 3%.

Dp. 14 Q. Suppose you run it up to 10, 20 or 30, what would happen then? A. The fluid would be so thick we would be unable to pump it or use it.

Q. What is about the highest you ever used Bentonite in a well, the highest percentage? A. Oh, six or seven per cent.

Q. But nothing like 10, 20 or 30? A. No.

Q. Now, you make up your drilling fluid now with either lime or caustic soda, bring it to a p. H. of about 12, you add a starch until you get your water loss down to where you want it, and you start drilling, and you just go to sleep then? A. No, it must always be maintained at a p. H. of 12 or above.

Q. What happens if you don't maintain it? A. It would ferment or decompose.

Q. So, just making it up and forgetting it wouldn't do? A. It would not be sufficient.

Q. You also have to add starch? A. Yes, you do.

Q. To maintain the water loss? A. To maintain the water loss.

Q. In the drilling of a well you start your drilling and keep on adding clay solids to it and maybe water will run into it? A. Yes. Dp. 15

Q. And sometimes you have to use a viscosity reducing agent even with starch? A. Yes.

Q. What do you use? A. Quebracho.

Q. How about Stabilite, one of these phosphates? A. They will work, can be used somewhat.

Q. Now, what water loss in c. c., cubic centimeters, do you try to get down to with starch? A. Try to get down to 5 or below.

Q. Can you do that with Bentonite? A. No.

Q. What is the highest you have seen Bentonite get it down to? A. With good water and no other device 10 would probably be a low, otherwise 15.

Q. How about if you encountered salt water? A. Your water loss would be very high.

Q. Now, with Zeogel what could you get the water loss down to? A. 50 to 55.

Q. In what fields have you seen this Impermex, that is, the starch, at a high p. H. system used, whether using caustic soda or lime? A. In Illinois, Kansas, Oklahoma, Colorado, Michigan. Dp. 16

Q. Is it still being used? A. It is being used extensively, especially the Gulf Coast, some parts of Oklahoma, and West Texas today.

Q. It hasn't gone out of the window at all? A. Oh, no.

Q. Do you know whether lots of Impermex is being sold? A. A great deal of it is being sold.

Q. Now, do you know what Quebracho is? A. Yes.

Q. It is a tannic acid, isn't it? A. It is.

Q. And what is it used for? A. It is used to reduce viscosity in different fluids.

Q. Has it been used for that purpose since you have had connection with it? A. It has for years.

Q. Supposing you use caustic and Quebracho? A. It is a thinning agent.

Q. Not a thickening agent, is it? A. No.

Dp. 17 Q. Is gelatinized starch used for that purpose as a thinning agent? A. No, gelatinized starch is not used for a thinning agent.

Q. In the wells where you get low water loss what does it do, increase or decrease the viscosity? A. Increased the viscosity.

Q. You said starch is used to reduce water loss? A. That is right.

Q. That is its primary purpose? A. Primary purpose.

Q. It is not used to prevent shale from heaving, is it? A. No.

Q. If you had no fermentation of starch in a well would you have to use either caustic or lime with a high p. H.? A. No, sir.

Q. Do you know what Quebracho does when you put it in water, dissolve? A. Dissolves, yes, sir.

Q. Forms a solution, doesn't it? A. That is right.

Q. What does gelatinized starch do when you put it in water? A. Increases the viscosity.

Q. I mean, what is it, it don't look like water, does it? A. No, it looks like gravy or paste.

* * * * * * *

Dp. 19 DELMAR H. LARSEN,

of lawful age, being produced, sworn and examined in behalf of plaintiff, deposes and says:

Direct Examination,

By Mr. Bruninga:

Q. State your name and where do you live and by whom are you now employed. A. My name is Delmar H. Larsen. I live in Los Angeles, California, and I am employed by the Baroid Sales Division of the National Lead Company.

Q. Give your education. A. I have two degrees in chemistry from the California Institute of Technology, and I am a registered petroleum engineer in the State of California.

Q. What are those degrees? A. Bachelor's degree in science and a Master's degree in science.

Q. What year did you get your Master's degree? A. The Master's degree was in 1936.

Q. What did you do after that? A. Almost immediately thereafter I entered the employ of the Dp. 20 Baroid Sales Division of the National Lead Company as a research chemist in the sale of drilling muds.

Q. At Los Angeles? A. Yes, Los Angeles.

Q. Have you been in charge of research in the laboratory there? A. Yes, I have for more than ten years.

Q. What has been the business of Baroid Sales Division? A. Almost entirely selling materials to people who drill oil wells and servicing wells while being drilled.

Q. Any particular part of the drilling operation? A. Mostly concerned with the drilling mud used in rotary drilling.

Q. Now, those include Baroid, Aquagel, Zeogel, Stabilite, is that right? A. That is right.

Q. Will you take them in order and say what they are used for? A. Baroid is a finely divided barium sulphate used to make drilling mud heavier so that the well will not blow out. Aquagel is Bentonite used to impart desirable gel characteristics for drilling mud and to produce a very thin filter cake on the walls of the hole. Zeogel is Dp. 21 a special type of Fuller's earth clay which has the ability of developing a structural gel in salt water muds and is used for that purpose in salt water areas. Stabilite is a mud thinner, consisting largely of polyphosphates of various kinds, is used to produce gel strength and viscosity.

Q. What does that do, increase or decrease viscosity? A. Zeogel increases the viscosity.

Q. And Stabilite decreases viscosity? A. That is right.

Q. I believe you also sell Tannex. What is that? A. Tannex is a Quebracho extract compound which is used as a mud thinner. Carbonox is another organic mud thinner, rich in humic acids, and is used for much the same purpose as Tannex.

Q. You also sell Quebracho, don't you? A. We used to sell it by itself, but now we sell it mostly incorporated in Tannex, which is about 75% Quebracho.

Q. Now, the Stabilite, Tannex, Carbonox and Quebracho are all mud thinners, are they not? A. That is right.

Q. As distinguished from Aquagel? A. That is right.

Dp. 22 Q. And as distinguished from clay, which is also a viscosity increasing agent? A. That is correct.

Q. Now, does Baroid Sales Division sell to drillers direct, or how does it market its products? A. We sell exclusively through distributors, but on a consignment basis, so while we are in contact with the drillers we do not sell directly to them.

Q. Now, you talked about a service, having Baroid service, what is that service and what is its purpose? A. We have about between eighty and one hundred trained drilling mud service engineers, who are for the most part either graduate petroleum engineers or chemists or chemical engineers, who are stationed in the various active oil fields where we sell our products. Each one has a laboratory built into his automobile and is prepared to carry out tests at the well on the drilling mud in order to see what shape the mud is in and what remedial measures must be taken to improve it.

Q. Now, you talked about drilling mud, that is a term applied to something, isn't it, it isn't just mud that you pick up out of the street? A. No, drilling mud is
Dp. 23 a generic term for all of the different types of fluids which are used in the rotary drilling process. One of these fluids, that is, one of these slurries, called drilling mud is always used in that process and fills the hole completely and is used for cooling the bit and removing the cuttings continuously during drilling.

Q. Now, you said these service engineers take a sort of laboratory with them, what kind of laboratory is it? A. They are equipped to determine the density of the drilling mud, that is, the weight, as it is usually called, the viscosity of the mud, the gel strength of the mud, which is the measure of plasticity of the mud, of the thixotropy of the mud, and moreover, they are equipped to make chemical tests such as salt content, acidity, by p.H. determination and the like. They are also equipped to make measurements of the filtration ability of the mud, the so-called wall building tests by which it can be determined whether the mud gives a thin cake and a low water loss or the opposite.

Q. Now, do those engineers make reports? A. Yes, their instructions are to make a report on each well visited, in the course of which they make a record of the characteristics of the mud as they have found it, and generally also as they left it after treatment.

Dp. 24 Q. Have those reports come to you? A. Yes; a carbon copy of each report goes, among other places, to the division office of the service engineer and also one to the home office, which is Los Angeles, so that all of these reports have always been available to me.

Q. Has all that been true for the last ten years? A. Yes, that is right.

Q. And has Baroid Sales Division done research work on drilling muds and materials? A. Yes, Baroid Sales Division has continued extensive research in drilling muds almost from the very beginning of its existence more than twenty years ago and its predecessor companies.

Q. Does it have laboratories? A. It has laboratories in Los Angeles, Houston, and Tulsa.

Q. What is the purpose of the research there? A. The research is carried on in order to develop new and also better materials for use in drilling muds, new processes of treating drilling muds and new ways and better ways of meeting field problems for areas in the handling of drilling muds.

Q. Do you know whether Baroid Service Sales Division of National Lead Company offers licenses to the Dp. 25 drillers on these various products on which it has patents? A. Yes, they do.

Q. Do those licenses require that any material be purchased from Baroid Sales Division? A. No.

Q. They are on a royalty basis, are they not? A. That is right.

Q. Is the royalty reasonable? A. It is generally considered to be so, yes.

Q. Do those licenses enable the driller to buy his material from other people and still pay the royalty? A. That is right.

Q. Now, as far as measurements of viscosity, gel strength and water loss is concerned, just how is that accomplished, by what kind of instruments? A. Viscosity is a measure of the ability of mud to flow through a tube, or in general, to be sheared, so that two somewhat different apparatuses have come into use in the drilling field for viscosity measurements. The first is a funnel, of rather simple type and metallic construction, in which the time of outflow of one quart of mud through a rather small tubulation is taken as a measure of the viscosity of the mud.

In another type of viscosimeter, the Stormer vis- Dp. 26 cosimeter, a sample of the mud is placed between two cylinders, one of which is rotated with respect to the other. The greater the resistance of the mud to such shearing action the greater will the torque be which is necessary to drive the rotating cylinder at a standard speed, which is generally taken as 600 r. p. m. where drilling muds are concerned.

Gel strengths are generally measured also with the Stormer viscosimeter. In this case the initial torque necessary to produce relative motion between the two cylinders is determined starting from a quiescent state.

Water loss is an important measurement, because oil is generally found in sedimentary strata and in the course of drilling a well through such strata with a mud in the hole of high enough density to exclude fluids which would otherwise force their way from the formations into the hole the mud will tend to filter out on porous formations which have been drilled through, the solids of the mud remaining behind as a filter cake and only the fluid portion of the mud, that is, the actual liquid of the mud, which is generally water, forcing its way into the porous formation. This leads on the one hand to a restriction of the effective working diameter of the hole Dp. 27 by reason of the built-up filter cake, and on the other hand damage to the formation by reason of the loss of water thereto. A simple test has been devised to determine the ability of a mud to resist filtration, and of course, the better the mud resists filtration the more desirable is its value in this behavior. The test consists of filtering a portion of the mud against a piece of filter paper at a pressure of one hundred pounds per square inch at a standard diameter of three inches of filter paper. The amount of fluid lost by the mud in a thirty minute test is taken as the so-called "water loss" of the mud and is probably the most important single measurement made on the mud aside from its weight.

pH is a chemical term which is in general use in chemistry and is a measure of the true acidity or alkalinity of liquids. The pH scale ranges from approximately 0 to approximately 14, neutrality being in the middle, that is, about 7. For example, distilled water when perfectly neutral has a pH of 7; a very strong acid may have a pH of between 0 and 1, and a very strong base (alkali), a pH in the range of 13 to 14.

Weight or density of the mud is determined by finding out the weight of a fixed volume of mud. This is generally done by a so-called mud balance, which is Dp. 28 essentially a container of fixed volume which is made part of a yard arm.

Q. Now, in what units are viscosity, gel strength and density given? A. Viscosity is either given in Marsh funnel seconds when taken with the funnel, or in Stormer centipoises. Gel strengths are generally given in Stormer grams; when one figure alone is given it is generally the number of grams weight applied to give initial movement after the mud is agitated. When two figures are given the first is the same as has been described and the second is the grams necessary to initiate motion after the mud has remained quiescent for ten minutes.

Density is given in either pounds per gallon or pounds per cubic foot.

pH is given in pH units.

Water loss is given in cubic centimeters, generally abbreviated "c. c."

Q. Now, why is it necessary to use a heavy enough drilling mud which will stop flow of water into the formation to be penetrated? A. It is characteristic of the subterranean porous strata that they often contain Dp. 29 fluids, in fact they generally do, the fluids being salt water, gas or oil, or mixtures thereof, and these fluids are often under very high pressures. In drilling a well it is necessary to keep these fluids confined to their respective formations, as otherwise they blow out or a geyser will result and the well drilling would be interrupted, sometimes permanently, and the well would be lost.

Q. Now, when you take these measurements of viscosity and gel strength, etc., are you content to take measurements at room temperature? A. No, naturally measurements at room temperatures are the most convenient to make and therefore they are the most often made, but in many cases it is not only desirable but necessary to make measurements at temperatures approximating those encountered by the condition in the well.

Q. How high do those temperatures go? A. They go as high as 250, 325 degrees Fahrenheit at the bottom of deep wells.

Q. That is way above the boiling point of water? A. That is correct.

Q. Now, on the matter of taking of these measurements, are you content with just taking one measurement, Dp. 30 or do you let the mud age? A. In drilling a well the mud is continuously changing because of the drastic mechanical and thermal working over which it gets in the course of drilling. A single measurement on a mud is, therefore, of only limited value. A much better idea of mud performance is obtained when a single mud sample is tested not only when first available but also after a prolonged period of heating or agitation or both.

Q. Now, as far as viscosity and gel strength is concerned this mud is pumped into the well, isn't it? A. That is right.

Q. And comes up on the outside of the drill pipe? A. That is right.

Q. Now, what are the limits of viscosity from a practical standpoint, and also gel strength? A. In view of the fact that the mud must be pumped through anywhere from two to twenty thousand feet of small bore drill pipe, anywhere from two to three and one-half inches in diameter, for example, there is a practical upper limit to the viscosity and gel strengths which mud can have and yet be pumpable; depending upon the gel strengths associated with the mud, the upper limit of viscosity is somewhere between 50 and 100 centipoises.

Dp. 31 Q. Stormer? A. Stormer.

Q. And what is the lower limit? A. The lower limitation of the viscosity is set by the necessity of the mud to lift cuttings to the top from the bottom of the well. Something like 10 to 15 centipoises is generally taken as a practical lower limit.

Q. What is the importance of the gel strength in a drilling mud? A. Gel strength enables the mud to lift cuttings from the hole, even though the upward rate of flow of the mud is rather slight, and it also enables the mud to hold weighted material in suspension.

Q. You mean this Baroid? A. Such as Baroid. The ability of the mud to increase its gel strength upon standing is of importance because that enables cuttings which are on their way up to be held in suspension should the drilling operation be suspended for any reason or be interrupted for any reason. On the other hand if gel strengths are too high the cuttings will not be released in the mud ditch on the surface and the mud will gradually load up with sand and cuttings and soon become unworkable. Very high gel strengths are also bad because they directly increase the pump pressures Dp. 32 necessary, and in fact if they are beyond certain upper limits it may be impossible to pump the mud at all.

Q. Now, you talked about interruption; how often during the course of drilling, say a thousand feet, is the drilling interrupted? A. With good luck in drilling, interruptions will only be necessary for the purpose of changing bits, except for the short interruptions of a couple of minutes or so required by the addition of successive lengths of drill pipe. The interruptions for bit changes require pulling out all of the drill pipe from the hole in order to get at the bit, and these interruptions become longer the deeper the hole and more frequent the harder the formation being drilled. Something between five and fifteen hours would be a good average for a bit change.

Q. Now, this weighting material, being ground barium sulphate or barites, how fine is that? A. It is ground so that 95% or more of its particles are finer than 325 mesh, which is the openings of a screen woven from wire mesh with 325 wires per lineal inch.

Q. It is, then, very fine? A. It is very fine indeed.

Q. That is very heavy, about over four times the Dp. 33 weight of water? A. The density of Baroid or barium sulphate is about 4.2 or 4.3 times the weight of water.

Q. Now, is it desirable to have that settle out as it comes out of the hole with the cuttings? A. No, it is extremely undesirable, and one reason it is ground so fine is to make it become part of the mud fluid itself so that it will never settle out.

Q. Now, in order to increase the viscosity what do you add? A. Viscosity is generally increased by adding, as circumstances dictate, clay, Bentonite, Fuller's earth, such as Zeogel, starch and other similar thickening agents.

Q. When you talk about starch what do you mean, raw starch? A. Starch in its emulsoid colloid form, that is, starch which has been pasted or gelatinized, as by cooking.

Q. Now, what do you do when that drilling mud gets too thick, what do you add then? A. Then it is necessary either to add water, which is not always desirable because that lowers the weight of the mud and also increases the water loss, or else one of several specific degelling agents which have been found to be valuable in drilling muds, such as polyphosphates or tan stuffs such as Quebracho extract.

Q. Now, when you use Aquagel or Bentonite, Wyoming Bentonite, what are the limits of the water loss Dp. 34 there in practical operation? A. One of the reasons for adding Bentonite, such as Wyoming Bentonite, or Aquagel, is to lower the water loss; generally speaking about 8 or 10 c. c. is the practical lower limit which can be achieved by the use of Bentonite.

Q. Suppose you hit a salt water, what then? A. Then the water loss of the drilling mud will go to very high values, for example between 50 and 150 c. c., in spite of the fact that the mud may have Bentonite in it.

Q. Now, does it take much salt to do that, lower the water loss? A. The water-loss-increasing effect of salt sets in at about one to two percent by weight of salt in the fluid phase of the mud and becomes very great for quantities in excess of five percent by weight of the fiuid base for the ordinary clay water or Bentonite water mud.

Q. How about Zeogel, which is Fuller's earth? A.

Zeogel is a special type of Fuller's earth which is a sort of micro asbestos and has the ability to impart a gel-like structure to muds regardless of salt content. The same asbestos-like structure, however, results in a complete lack of water loss reducing properties for this material.

Q. Does it then have a high water loss, or low Dp. 35 water loss, Zeogel? A. Zeogel water mud has a very high water loss.

Q. Do you know what an emulsoid colloid is? A. Yes, of course. That is a general term used by colloid chemists and many things in colloid chemistry are obscure generally.

Q. Well, can you give me generally what it means in a practical operation? A. Yes, in a practical way and the commonly accepted use of the term, an emulsoid colloid is a water-avid, water swelling substance such as pasted starch, water dispersible gums such as gum tragacanth, and highly colloidal clays such as Wyoming Bentonite; also many proteins, such as gelatine, are good examples of emulsoid colloids.

Q. Is raw starch itself an emulsoid colloid? A. No.

Q. If you put it in water does it swell, at ordinary temperature? A. No, it does not swell. Its very property of not swelling is used in extracting starch in most of the processes for obtaining starch from cereals and roots.

Q. Are you familiar with the Harth patent 1,991,637* issued on February 19, 1935? A. Yes.

Dp. 36 Q. As the patent shows, it was assigned to National Pigments & Chemical Company, what relation does that have to National Lead Company? A. At the time of the assignment I believe that the National Pigments & Chemical Company was a wholly owned subsidiary of the National Lead Company. It has since become amalgamated into the National Lead Company completely.

Q. How early did you become familiar with that patent? A. I became familiar with this Harth patent shortly after the commencement of my employment with the National Lead Company, Baroid Sales Division, which was in July of 1936.

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* Plaintiff's Exhibit 8.

Q. Now, it is entitled "Application of Mud Laden Fluids to Oil or Gas Wells." It mentions, among others, Bentonite, and then it states, page 2, right: "Other suitable concentrated colloidal suspending agents and more particularly emulsoid colloids may, however, be employed to attain some or all of the objects and advantageous features of this invention. Examples of these are starch * * *." Were you familiar with that statement in 1936? A. Yes, I was.

Q. What kind of starch is meant there when it mentions it is an emulsoid colloid? A. Clearly it must be a
Dp. 37 starch which is in an emulsoid form, that is, a starch which has been caused to gel in water.

Q. Gelatinized starch? A. Yes.

Q. It is not a raw starch? A. No, raw starch could not behave as an emulsoid colloid.

Q. The patent furthermore contains the statement, page 1, right: "The concentrated colloidal suspending agent may be a suitable one adapted for the particular suspendable base or disperse phase and the dispersion medium." Now, the dispersion medium in a water base drilling mud was what? A. Water.

Q. Now, at the time in 1929 when the application was filed and in 1935 when it issued what was the water phase that was encountered, only fresh water? A. No, it depended entirely upon what particular field, and indeed what particular horizon of the field was being drilled. At both of the times which you state very large portions of the United States where oil was being drilled for were such as to cause the condition to become briny, that is, loaded with salt.

Dp. 38 Q. In other words, the dispersion medium could be salt water? A. That is right.

Q. And you saw that statement too in 1936, didn't you? A. That is right.

Q. Now, can you tell me when, about when, that Baroid Sales Company started with its investigation for the use of starch and particularly starch colloid or gelatinized starch? A. We began active work about a period 1939 to 1940.

Q. Was that research just a little bit, or did it extend for some period of time? A. Oh, it extended for some time. In fact, that has been an active research project with us ever since and we are still continuing our research and development work in that phase of drilling mud.

Q. Did Baroid Sales develop a particular kind of starch for that purpose? A. Yes, we developed a particular type of dry pregelatinized starch which is sold as "Impermex."

Q. Were you the person put on that job? A. Yes, I was.

Q. I call your attention to the Larsen patent 2,417,307* patented March 11, 1947, original application filed February 24, 1941. Are you the Mr. Larsen of that

Dp. 39 patent? A. Yes, I am.

Q. Was that particular thing put out as "Impermex," that starch? A. Yes, it has been and is now.

Q. Well, what happens if you put gelatinized starch into a drilling mud and keep on drilling? A. It behaves as an emulsoid colloid, in that it generally thickens the mud and generally lowers the water loss.

Q. But what happened in 1940, 1941, when you continued drilling, would it stay that way, or would something happen? A. Well, depending a little upon the type of mud, in some cases fermentation was encountered.

Q. Was that just in a few cases that fermentation was encountered? A. Well, it was generally encountered whenever the mud was not completely saturated with salt.

Q. Well, I am talking about fresh water first; what happened then? A. It was our experience that the starch always fermented in fresh water muds.

Q. By that you mean gelatinized starch? A. That is right.

Q. Now, what was the result when it began to ferment?

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* Plaintiff's Exhibit 9.

A. The end result was that the mud was in poorer Dp. 40 shape than it was before the starch had been added initially because the breakdown products of starch fermentation are acids which flocculated or curdled the mud and rendered it generally unfit for use, particularly when large amounts of starch had been added and had subsequently fermented.

Q. What happened to the water loss? A. The water loss went to rather high values, generally higher than the water loss before treatment had begun, because of the acids produced.

Q. What happened when gas got into the hole at the bottom of the hole? A. You mean, with a starch mud which had fermented?

Q. Yes. A. Generally, because of the flocculation caused by the acid mud, the gas would stay in the mud and make it fluffy, causing it to lose density. However, such muds were generally discarded.

Q. Well, the act of fermentation itself, did that set off any gas? A. Yes, that would set off substantial quantities of gas which appeared to be carbon dioxide.

Q. Are you familiar with the Sikes and Beesley application in suit No. 489,890?* A. Yes, I am.

Dp. 41 Q. That was filed on June 7, 1943, about three years after you started to work in it, three or four years after you started to work on it. Do you know what that application is about? A. Yes, I do.

Q. You helped to revise it, or helped me to write it, didn't you? A. Yes, I had a hand in its draft.

Q. What is generally the purpose of the process of that application? A. The purpose is to produce a stable starch treated mud, of desirable drilling mud characteristics, which is moreover stable and completely free from fermentation problems.

Q. How is that accomplished? A. That is accomplished by raising the alkalinity of the mud to a pH of around 12 and keeping it there.

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* Plaintiff's Exhibit 1.

Q. Is it simply necessary to start your drilling fluid in a pit or whatever you make it up in and bring it to a pH of 12 and then add to your gelatinized starch and then let her go, or what happens if you continue drilling? A. Well, starting out, mud which has been brought up to specifications, that is, which has the desired amount of starch and the desired pH of around 12, such a mud would not long remain in that condition if drilled with, but it Dp. 42 would be necessary to make additions of the alkalinizing agent from time to time, generally every day or every other day, and also generally make up additions of the gelatinized starch.

Q. Now, when you continue the drilling what happens to the cuttings, are they all carried up and settled in the ditch, or screened out? A. Depending on their nature, the cuttings which arrive at the top are large enough to be either screened out or settled out or removed from the mud system with of course a certain amount of mud adherent to the cuttings, which causes some loss in the mud, and others of the cuttings may become incorporated in the mud, particularly if they break down to a fine size before they reach the top of the hole.

Q. How about water encountered during the course of drilling, does that get into the mud, not in large volume, but let's say in little springs? A. Certainly the amount of water which is in formations being drilled up gets into the mud, and in some parts of the country small seepages under very high pressures of water, particularly salt water, are encountered, as in south Louisiana, although generally speaking the weight of the mud is maintained high Dp. 43 enough to shut off any large inflow of water.

Q. Well, as a result during the course of ordinary drilling does that drilling mud stay the same at a pH of 12 after you have once brought it to a pH of 12? A. No, even a simple mixture of starch and caustic, particularly if maintained at an elevated temperature, will undergo a slow change, resulting in a lowering of pH.

Q. What methods are used in this application to bring the drilling mud to a pH of about 12? A. In the Sikes-Beesley application?

Q. Yes. A. Such strong caustics as caustic soda, caustic potash, and lime, that is, hydrated lime or quick lime.

Q. Is hydrated lime feasible for that purpose, or is it being used? A. Yes, it is.

Q. Just a little bit, or to a large extent? A. It is quite extensively used. In the majority of cases where the Sikes-Beesley process is used at all lime is added to the mud system.

Q. Can you tell me whether this process of maintaining a drilling mud at a high pH of about 12 and using gelatinized starch or starchy colloid has gone into use
extensively or just a slight use? A. It has gone
Dp. 44 into quite extensive use. I do not have the exact
statistics at my finger tips, but I would estimate that at the present time upwards of 200 tons per month of starch in its gelatinized form are used in accordance with the Sikes-Beesley process. The actual figure for the whole United States is undoubtedly somewhat larger than that, or considerably larger than this, but I am certain of my own personal knowledge of the 200 ton figure.

Q. You talked about maintaining a salt concentration of the drilling fluid. Does that inhibit fermentation where gelatinized starch is used? A. If mud is maintained saturated with salt, then it has been our experience that starch will not ferment in such a mud, although it has been found necessary to maintain the saturation substantially complete.

Q. What is the saturation percentage of salt? A. 26% of sodium chloride by weight of fluid phase.

Q. You mean the ordinary salt? A. That is right.

Q. Ordinary table salt? A. That is right. The ordinary salt which is encountered in drilling is sodium chloride.

Q. Then, if you don't encounter salt you have to
Dp. 45 add it, don't you? A. That is right. Even in such
areas as West Texas where hundreds or even thousands of feet of salt formations are penetrated and the

mud becomes saturated with salt it is not uncommon for operators to bring along salt in bags and add it to the mud to make sure the mud is saturated with salt.

Q. Is that expensive? A. Yes, it is not inexpensive.

Q. What effect does that have on the steel drilling pipe and the casing? A. Salt solutions are generally rather corrosive.

Q. Now, can you use raw starch in a drilling fluid? A. Not to any good purpose. You can add it to a mud, of course, but nothing will happen.

Q. Now, I have two citations here, one of them cited by the Patent Office, it is Stern Bureau of Mines bulletin,* February, 1941, page 77, which states: "Starch is inferior to bentonite in those muds in which bentonite is effective, namely, fresh-water mud. Neither starch nor bentonite is effective to prevent filtration in a salt-water mud." He is talking about starch? A. Evidently.

Dp. 46 Q. Do you agree with that? A. Well, that is a true statement, if by "starch" is meant ordinary commercial starch.

Q. If he don't mean gelatinized starch? A. That is correct.

Q. Yes, but he says in the next sentence then: "It is only recently that starch has found application in drilling muds as a result of the development that hydrolyzed starch imparts a good filter test to salt-water mud." Now, in that statement he certainly means gelatinized starch? A. Yes.

Q. Well, look at the two statements, then. What is your idea, that in the first statement he refers to plain starch, or hydrolyzed, or gelatinized starch, when he says it is no good? A. He must refer to raw, ungelatinized starch in the first case.

Q. Now, furthermore, I have here a publication by Gray, Foster and Chapman of Humble Oil & Refining Company, Houston, Texas, in Technical Publication No. 1351 of American Institute of Mining and Metallurgical Engineers,† delivered in New York February, 1941. Do you know who those men are? A. Yes, I do.

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* Defendant's Exhibit D.

† Plaintiff's Exhibit 7.

Dp. 47 Q. Do you know any of them personally? A. I know Gray very well and have met Chapman and Foster.

Q. Are they recognized as being pretty good in this field? A. Yes, they are.

Q. At least good enough to be permitted to present the paper before the American Institute of Mining and Metallurgical Engineers, is that right? A. That is right, and the paper was sponsored by the Humble Oil & Refining Company.

Q. Now, they state on page 4 of that paper, right column: "To be effective the starch must be gelatinized or pasted. The addition of dry starch or a dispersion of starch in cold water, whether untreated or the so-called soluble-starch, is equivalent to the addition of a like amount of inert material." Have you taken cornstarch and shaken it up in cold water? A. Yes.

Q. What happens to it? A. It settles down to the bottom again in a short period of time.

Q. And that would happen in a drilling fluid, wouldn't it? A. Well, it might have an opportunity to settle, but it would remain in the fluid as unswollen starch granules, with no particular effect on the preparation of the mud.

Dp. 48 Q. Then they continue: "Gelatinization consists in the rupture of the amylopectin cell membrane and swelling of the cell contents. This change in structure is revealed in Fig. 6." What does "Fig. 6" show at the right and left, on page 6? A. Figure 6 shows on the left a photomicrograph of ordinary dry raw starch and on the right what is evidently the same starch after gelatinization in water.

Q. Then they continue: "Among the various agents that accomplish the pasting of starch, the most potent is caustic soda. The relative amounts of starch and caustic soda may be varied between rather wide limits, and the composition selected is determined by consideration of the convenience of handling the pasted mixture. A practical suspension for addition to drilling mud contains 10 per cent by weight of starch and 1 per cent of caustic soda." Referring to that last part over there, will that convert starch from the inert starch to the gelatinized starch, so far as your experience goes? A. Yes, that will.

Dp. 49 Q. Now, I am going to call your attention to a real old patent, the Marsden patent, No. 376,445,* dated January 17, 1888. Page 1, left, beginning line 44, reads as follows: "The proportion of ingredients which I have found suitable for this form of paste is as follows: about eighty-four parts of flour, &c., to eight parts of pulverized caustic soda or caustic potash." What is the ratio of that? A. The ratio is 10½ to 1.

Q. Just about what Gray, Foster and Chapman say, is that right? A. That is correct.

Q. Now, continue again where Gray, Foster and Chapman talk about what they used in the field, they state, page 77: "Starch was intimately mixed with water by adding the starch through a mud-mixing hopper. Caustic soda was added, and the white, pasty mass was agitated with steam until a viscous, straw-colored suspension resulted. The final composition of the mixture was approximately 89 per cent water, 10 per cent cornstarch and 1 per cent caustic soda. The mud in the pit was stirred vigorously with the guns while the starch suspension was added." Now, that mixture, that relation is again

Dp. 50 10 to 1, isn't it? A. That is correct.

Q. As given by Marsden, as given by Gray, Foster and Chapman before, and also as given in the field tests which I have just quoted from? A. That is correct.

Q. Now, they don't say anything about pH there, do they, in that whole paper, of the mixture anyway? A. No, I do not find any mention of pH in this paper.

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* Plaintiff's Exhibit 10.

Q. Keep in mind, though, that they say that the ratio can be between wide limits. Have you any authorities, scientific authorities, that tell you what pH is required to gelatinize starch where you use caustic soda? A. I can refer you to a couple of papers which state the amount, the minimum amount of caustic soda necessary in your aqueous solution in order to paste or gelatinize starch.

Q. By the way, can you read and translate both German and French? A. Reasonably well.

Q. You have done some of it, haven't you? A. Yes.

Q. Can you refer to two of the authorities? A. Yes. The first which I will refer to is an article by Reychler,
R-e-y-c-h-l-e-r, published on pages 309 to 317 of
Dp. 51 Volume 29 of the Bulletin de la Societe Chimique
de Belgique, and entitled "Etudes sur la ficule."

Q. What does that mean? A. "Studies of starch"; in the Bulletin of the Chemical Society of Belgium.

Q. Is that an authoritative bulletin? A. Well, it is the standard bulletin of the Belgium Chemical Society, which is, naturally, a well recognized organization.

Q. Well, now, read what Reychler says about the pH required to gelatinize the starch. Don't read the French, but give the page and translate it freely. A. He states on page 311, speaking of gelatinizing agents for starch: "The activating agents par excellence are the caustic alkalies. A solution of about 0.76% of KOH or 0.55% of NaOH, stirred very gently with small quantities of starch, permits the study of the formation of the paste in the polarizing microscope. * * * Thus I would consider as typical the rapidity of action of a solution of about 0.135 mol of alkali per liter." I might explain the last sentence
by stating that in chemical language 0.135 mols
Dp. 52 of NaOH, that is caustic soda, is equivalent to
0.55% of caustic soda by weight.

The second article which I would refer to is an article by Wolfgang Ostwald and Gerhard Frankel in "Kolloid Zeitschrift", Volume 43, pages 296 to 312, of the year

1927. The title, translated, is "Kinetic Studies about Starch Gelatinization", subtitle "On the cold pasting of starches."

On pages 302 and 303 of this article it appears that a solution of caustic soda containing 0.150 mols per liter gives very slow swelling of the grains of the starch granules, while a solution of caustic soda containing 0.160 mols per liter gives rapid pasting of starch. 0.150 mols per liter is approximately 0.60% caustic soda by weight, from which it will be seen that the results of Ostwald are in agreement with the results of Reychler.

Q. Now, can you tell the Court who Ostwald is? A. Wolfgang Ostwald has been called the father of colloid chemistry. For many years he was the editor of what was the only journal of colloid chemistry in the world, "Kolloid Zeitschrift", that is, "Colloid Magazine".

Q. In other words, both of those authorities agree that in order to gelatinize starch in cold water the alkali, particularly sodium hydroxide, must be at least 0.55%? A. Yes.

Dp. 53 Q. And not anything like one-third of one per cent? A. No, one-third of one per cent caustic soda in water is insufficient to paste starch at ordinary temperatures.

Q. Well, now, to carry this a little further, one of those authors refers to calcium hydroxide, hydrated lime, to paste starch, do they? A. The Ostwald article refers briefly to calcium hydroxide on page 299 as one of the chemicals included in the experimentation, but I have gone through the article very carefully and cannot find any reporting of results with lime.

Q. Have you been able to find any magazine or book at all that says that starch can be gelatinized with calcium hydroxide, or with lime? A. I have made a quite thorough search and I cannot find any statement one way or the other as to whether lime will paste starch. My inference is simply from the literature studies alone that it will not paste starch in the cold, and this is no doubt the reason why authors are silent on it.

Q. Have you verified that yourself experimentally? A. I have verified that myself experimentally, using cornstarch.

Dp. 54 Q. Now, Mr. Larsen, referring to your personal investigation of this matter of the amount of caustic soda required to gelatinize starch and whether hydrated lime will gelatinize starch, you have given me a paper entitled "Raw Starch Treated With Caustic Soda NaOH and hydrated lime Ca(OH)2."* Where were those investigations performed? A. These were made in Los Angeles in the Baroid Sales laboratory there.

Q. Under your supervision? A. Under my direct supervision.

Q. You were really there while they were being done? A. Yes.

Q. Your office is right off of the laboratory? A. Yes. I observed the actual experimentation.

Q. Now, will you explain, there are two parts there, first 1 to 5 relating to caustic soda and 6 to 9 relating to hydrated lime, just tell what you did. A. These experiments were made by taking 100 cubic centimeters of distilled water and stirring three grams of cornstarch into the water. This resulted in a milky suspension, which settled out rather quickly. The viscosity of the suspension was the same as that of water, as appears from the table, line 1.

Dp. 55 Q. Nothing was added? A. That is right, nothing was added. This is merely the blank showing the starch and water. It was milky at first and settled out after thirty minutes and the next day even the very finest starch granules had settled, leaving clear supernatant liquid.

In experiments 2 to 5, inclusive, progressively larger amounts of caustic soda were added, and in each case the pH of the suspension was determined and the viscosity by means of a Stormer viscosimeter, and observations were made of the character of the suspension, particularly after settling. All of these tests started out with 3 grams of cornstarch in 100 cubic centimeters of distilled water, the caustic being stirred in later in accordance with the tabulation.

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* Plaintiff's Exhibit 4.

Q. Now, that cornstarch was ungelatinized starch? A. That is right, it was ordinary cornstarch purchased in a grocery store.

Q. I want you to explain this to the Court. We are using the metric system here and we are talking about 100 c. c., what does 100 c. c. of water weigh? A. 100 grams.

So that an addition of one gram to 100 c. c. of water is an addition of one percent by weight.

Dp. 56 Q. Now, go ahead. A. It will be seen that additions of caustic soda of one-tenth per cent and five-tenths per cent by weight successively increased the pH to 12.0 and 12.5 but there was no general pasting of the starch. It is evident that there may have been the least bit of incipient gelatinization, probably confined to the finest grains of starch in test 3 where 0.5 grams of caustic were added with a resultant pH of 12.5, but from the observations of settling over night this percentage of starch which may have gelatinized was very low, probably less than one per cent, judging from the turbidity. On the other hand, the addition of one per cent caustic soda, that is 1.0 gram, resulted in complete pasting of the starch, as evidenced by the viscosity of 39 times that of the original suspension; the complete disappearance of the milky appearance with it changed to a fairly clear, translucent gel, and no settling whatsoever. The pH in this case was 12.6.

The highest addition of caustic, that of experiment 5, of 2%, gave a pH of 12.7 and substantially the same results as in experiment 4, namely, complete pasting with the formation of a translucent gel.

Q. Now then, your experiments, are they in agreement, or disagreement with Reychler and Ostwald? Dp. 57 A. They appear to be in clear agreement with both Reychler and Ostwald, because I found a percentage of caustic soda, just less than that proposed by Reychler and Ostwald to be the critical lower limit; I got no pasting, whereas at just above this I got complete pasting.

Q. Now, the difference in pH between 0.5 and 1.0 is only from 12.5 to 12.6. Now, by a scale what is that on, linear? A. Well, pH scale is a logarithmic or exponential scale. It is something like compound interest, a change of a single pH unit, as, for example, from 12.0 to 13.0, actually means a tenfold increase in alkalinity.

Q. That is also true of page 50 of the Solvay blue book cited by the Examiner, isn't that right? A. Yes, that is the case.

Q. Now, you want to proceed next with the hydrated lime? A. Yes. We added the same amounts of hydrated lime in experiments 6 to 9 as we had previously added of caustic soda in experiments 2 to 5. In none of these cases where hydrated lime was used did we get any pasting whatsoever or any substantial increase in viscosity. The complete settling out of the starch in experiments 6 to 9, inclusive, with a clear supernatant liquid, indicates no pasting at all. These results are explainable readily Dp. 58 on the basis of the limited solubility of calcium hydroxide. The maximum solubility of calcium hydroxide at ordinary temperatures is about 0.16%, and this even decreases at rising temperature. This results in the maximum pH obtainable with calcium hydroxide of about 12.4%, which, as will be seen from comparison with experiments 2 to 5, appears to be insufficient to bring about pasting or gelatinization of the starch.

Q. But you do use lime to bring this pH of your drilling fluid up to 12? A. Oh, yes indeed.

Q. So, if you take any kind of a fluid, whether drilling fluid or anything else, and add 2 grams or 2% of hydrated lime to give you a pH above 12, say 12.4, and you put some ordinary starch into that will you get any gelatinization? A. No.

Q. Now, I think you said Quebracho extract was a tannic acid, is that right? A. It is a crude tannic acid.

Q. And if you react it with caustic soda what do you get? A. You get the sodium salts of the crude tannic acids in Quebracho extract which is generally known by the term "sodium tannate."

Dp. 59 Q. Now, whether you put either Quebracho or any of the other tannins or the sodium tannate into water what does it form? A. It forms a solution.

Q. Can you look through it? A. You can look through it, particularly when diluted, although most of the tanstuffs are highly colored, so you can look through it in the same sense you can look through ink.

Q. But it is definitely a solution, is that right? A. Oh, yes, it is a solution.

Q. Now, what is Quebracho or any of the tannins or one of the tannates, is it a viscosity increasing, or viscosity reducing agent? A. The tannates or tanstuffs are viscosity reducing agents.

Q. Is that true of tannic acid, too? A. Yes, tannic acid is the term for the more or less purified tannic acid obtainable from ordinary tanstuffs.

Q. Was Quebracho being used as a viscosity reducing agent when you came to Baroid in 1936? A. Yes, it was in wide use.

Q. Is it still in wide use today? A. Yes, it is.

Q. Now, are you familiar with the Lawton, Loomis
Dp. 60 and Ambrose Patent No. 1,999,766?* A. Yes.

Q. A patent of April 30, 1935? A. Yes, I am.

Q. What is that patent about? A. That patent describes the treating of a drilling mud by adding small amounts of weak acid such as tanstuffs together with caustic soda.

Q. And what does that form? A. It forms, when tanstuffs are used, sodium tannate.

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* Plaintiff's Exhibit 11.

Q. Now, can you tell me the maximum percentage of caustic that is added to the drilling fluid given in that patent? A. It may be calculated either from the data on the middle of page 3, column one, or the amounts given in the claims that the maximum amount of caustic soda is 0.2 per cent by weight of the drilling fluid.

Q. In other words, it is one-fifth of one per cent, is that right? A. That is right.

Q. And is the difference between one-fifth of one per cent and one-third of one per cent so great that anyone can call it effective 50 to 100 times? A. I think it is a distortion of arithmetic.

Q. Now, what is the maximum amount of Quebracho that is specified in that Lawton patent? Dp. 61 A. Calculated in the same way, about one-third as much tannic acid, which will compute on the same basis to one-fifteenth per cent by weight, as computed on page 3, or about one-tenth as computed from the percentages given in the claims.

Q. Now, let's take raw starch. Is that a viscosity reducing, or viscosity increasing agent? A. Raw starch is neither one; it is inert.

Q. Well, let's take gelatinized starch; is that a viscosity reducing agent? A. Gelatinized starch is generally a viscosity increasing agent.

Q. In the Harth patent 1,991,637 it is classed with bentonite, isn't it? A. Yes.

Q. And have you performed experiments on gelatinized starch, I mean, outside of this suit, maybe long before, whether starch was a viscosity increasing agent so it would hold things in suspension? A. Yes, it certainly is and certainly does. As a matter of fact, many times we like to use prodigious quantities of starch in mud, but we cannot always add as much as we want because Dp. 62 the starch thickens the mud, the gelatinized starch thickens the mud.

Q. Well, let's take Figure 3 of our application in suit.

What does that show, particularly using an amount of starch where you get low water loss as compared with claims, what does that show, viscosity increase or viscosity reduction? A. It shows a viscosity increase as starch is added.

Q. Initially it shows a reduction, though, doesn't it, reduction in viscosity? A. Initially there is a viscosity reduction on the addition of starch, that is right.

Q. But the water loss there, where the lowest viscosity is, is 15, isn't it? A. That is right.

Q. But at a water loss of 5? A. The viscosity starts to increase as more starch is added.

Q. Actually in the use of starch at a pH of 12 when the viscosity gets too high what do you use, more starch, or Quebracho? A. Quebracho.

Q. Is that used with starch today in the field to get the reduction of viscosity? A. Yes, quite commonly.

Dp. 63 Q. Now, take that Stern proposition of 1941 relied on by the Patent Office; when did you become familiar with that? A. Mr. Stern was employed by the Bureau of Mines, and I first knew he was preparing such a bulletin when he came through Los Angeles collecting material. This was, I believe, some time in 1940.

Q. And it was before February, 1941, wasn't it? A. Oh, yes. In fact, Mr. Stern sent me a preliminary manuscript copy of the bulletin before it was finally published in February, 1941.

Q. Did that tell you at that time, or any time since, that you should bring a drilling fluid to a pH of 12 and maintain that where you use gelatinized starch? A. No, it did not.

Q. Were you still struggling with the problem in 1941? A. Yes, we were.

Q. And fermentation was going on, was it? A. That is right.

Q. Do you know whether that bulletin of the Bureau of Mines was just sent to you, or was it accessible to the public drilling wells? A. It had very wide distribution and was given publicity in all the oilfield trade journals.

Q. Well, did you ever hear of anybody using a drilling fluid at a pH of 12 with gelantinized starch before

Dp. 64 Sikes and Beesley did it? A. No.

Q. Now, what does that statement that the Examiner has quoted there on page 77 mean to you where he talks about "It is only recently" down to "distribute"? A. I think it is very clear that that refers to the technique which was used in West Texas at that time and which is somewhat more fully described by the Gray, Foster and Chapman article previously referred to. Stern in this Bureau of Mines bulletin is talking about the starch solution which is boiled up for subsequent addition to the drilling mud from the well.

Q. Well, what is he talking about when he says a pH of 11 or 12, is he talking about a drilling fluid, or about the starch solution? A. It is quite clear to me that he is talking about the pH, the cooked-up starch solution.

Q. Has anybody ever, outside of the Examiner in this case, to your knowledge contended that meant the drilling fluid pH? A. Not to my knowledge.

Q. Do you know John Dodge, who gave an affidavit in this case?* A. Yes, I do.

Dp. 65 Q. Who is he, anyway? A. He is a petroleum engineer of quite wide experience who was for many years head of the petroleum engineering department at the University of Southern California and was later manager of the Pantepec Oil Company in Venezuela. He is now a petroleum engineering consultant.

Q. What is his standing in the profession, high, or low? A. It is very high, I should say.

Q. Do you know him personally? A. I know him personally.

Q. From what you know of him personally do you think he would make a statement about that thing of his own opinion, or otherwise? A. I am sure that he wouldn't make any statement about anything unless it were from his actual knowledge of the matter.

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* Plaintiff's Exhibit 3.

Q. Now, that particular Stern authority issued in the same month as was the Gray, Foster and Chapman paper of February, 1941, and in the footnote on that page the statement is, after talking about using starch in drilling fluids: "This starch treatment is less expensive than the silicate drilling fluid and according to Cannon Dp. 66 may be at least equally as effective." Now, the footnote reference is to George E. Cannon, Humble Oil & Refining Company, Houston, Texas. Do you know George Cannon? A. Yes, I do.

Q. And was he connected with the same company as Gray, Foster and Chapman were connected with? A. Yes, they were all with the drilling division of the Humble Oil & Refining Company in Houston.

Q. Now, in the paragraph following that statement of Mr. Stern on page 77 what is he talking about, is he talking about preventing fermentation by high pH or by salt or something else? A. He is talking about preserving the starch with sodium chloride, that is, salt, dissolved in the mud.

Q. He also refers to Barnes, doesn't he? A. That is right.

Q. What did he say Barnes proposed? A. He says: "Barnes also proposes the use of starch, with an alcohol, to attain the same objective," that is, an "improvement in the filter test."

Q. Does Barnes alcohol increase the pH of the drilling fluid to 12 or to any at all? A. As I recall it, in Barnes' drilling fluid, as described in the Barnes patent, there is no particular increase of pH.

Dp. 67 Q. What he used was something like, or some germicide, isn't that right? A. Barnes proposed to add an alcohol of medium chain length in order to inhibit foaming in starch muds.

Q. Now, as far as Mr. Stern's statement is concerned above that quoted, is that any different from the following statement that I quoted a little while ago from the Gray, Foster and Chapman paper, at page 5: "A practical suspension for addition to drilling mud contains 10% by weight of starch and 1% of caustic"? A. The proportions are identical.

Q. That is experimental now. When you talk about the actual for field use on page 7 is Stern any different from the following: "The final composition of the mixture was approximately 89% water, 10% cornstarch and 1% caustic soda"? A. No, there is no difference. The identical figures can be deduced from Stern.

Q. And Stern, as you will note, had talked to Mr. Cannon, who is associated with Gray, Foster and Chapman, is that right? A. That is right. I had heard of Mr. Stern coming through Houston on this tour of gathering material for the bulletin.

Dp. 68 Q. Now, the Gray, Foster and Chapman paper, what do they rely upon to prevent fermentation? A. The starch muds of the Gray, et al., paper were west Texas muds where the muds were saturated with salt. In fact, the problem which Gray, et al., apparently set out to solve was the high water loss ordinarily encountered in salt muds. If you check the title of their article, possibly.

Q. Now, it was the salt in a drilling mud that kept fermentation from taking place, is that right? A. That is correct.

Q. Is that any different from what Mr. Stern talks about on page 77 when he talks about the use of sodium chloride as a preservative? A. No, that is the same, except that Stern is a little low on the necessary salt concentration for absolute preservation. We know now that 10% salt will prevent fermentation for some time, but not permanently.

Q. Now, take the Gray paper, where the Gray, Foster and Chapman paper, he is stating what the mixture is, on page 7, and then on the next page they talk about adding that to a drilling fluid, taking that paper and disregarding any tests you may have made to determine that point, what do you figure about the pH of that drilling Dp. 69 fluid would be that is added to the drilling fluid? A. From what I know of west Texas muds and the proportions involved I would estimate that the pH of the drilling mud described in the column one of page 8 of the Gray paper was somewhere in the range of about 8½ to 10.

Q. Have you verified that by carrying on experiments? A. Yes, I have, laboratory experiments carried on in Los Angeles.

Q. I hand you a paper which you gave me entitled "Stern Bureau of Mines, February 1941 (Gray, Foster and Chapman paper, February, 1941),"* and it first contains the extract from Stern and then contains an extract from the Gray, Foster and Chapman paper. Tell me what you did. A. I took the recipe for making the suspension of caustic soda, water and cornstarch for mud drilling given in the Stern paper and somewhat more explicitly in the Gray, Foster and Chapman paper, particularly as detailed at the bottom of column 2 of page 7 of the latter. Specifically, I took one part of caustic soda, 89 parts of water and 10 parts of cornstarch and passed live steam into it until the color became a light straw.

Q. Was that the practice that was used at that time? A. Yes. I, in fact, have seen this carried out in west Texas at the well.

Dp. 70 Q. All right. A. After this had happened I determined the increase in weight of the slurry and it appeared to be only about 1%, so that the relative proportions of water, caustic soda and cornstarch were substantially the same. I measured the starch solution both before and after the steam treatment and obtained the results respectively of 12.7 before and 12.5 after.

Q. Of the mixture? A. Of the mixture. This was carried out with distilled water and the pH could well have been lower had a typical west Texas water been used, for example.

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* Plaintiff's Exhibit 5.

Q. Which water is alkaline, west Texas water? A. Rather alkaline and hard.

Q. So, can you say you carried it out under at least as favorable conditions as must have been carried out in that paper? A. Yes. I believe that by using distilled water the pH's were as high as would ever be obtained.

Q. All right, go on. A. Then I took, first of all, El Paso clay, which is a widely used clay obtained near El Paso, Texas, and sold for use in the west Texas and New Mexico oil fields, and made it into a mud with saturated salt water in the proportion of 20 grams of clay and 80 grams of brine. This approximated a typical west Texas mud after penetrating both the "red beds" which yield a clay something like El Paso and also drilling through sufficient salt to saturate it. Dp. 71

Q. Were you familiar with those Texas clays? A. Yes, I have and also at the time had spent some time in west Texas on well drilling mud problems.

Also I prepared another mud with an Ada Oklahoma clay, which although is not now sold because the company has gone out of business, but was sold in the period, for example, 1940-1944 for use in drilling muds, into a saturated salt mud in the same proportions that the old El Paso clay was used.

Finally I took a shale mud from a well being drilled near Houston, Texas, which was as nearly as any natural mud is, nothing more or less than the natural drilled-up shales and surface water. This was rather thick and was thinned down with water.

Q. On that No. C there, this Texas mud near Houston, you didn't use salt water there. Which gives the most favorable, highest pH, fresh water or salt water, if you add something to it, caustic? A. In general additions of a given amount of caustic to a salt water mud will result in a smaller increase in pH than Dp. 72

similar additions to a fresh water mud, that is, in the case of salt water muds the pH will be lower.

Q. All right, go on. A. Now, to each of these three muds, to portions thereof, I added the cooked-up caustic starch solution which had been previously prepared in such proportions as to give 0.2, 0.3, 0.5, 0.7, 1.0 and 1.5 per cent by weight of starch in the mud. I used these proportions not only because the one shown in the Gray, et al. article, wherein it recites 1.5% by weight of starch in the mud was the maximum, but also because these are the practical proportions which can be used, larger concentrations leading to too great dilution of the mud because the drilling mixture contemplates only 10% starch; the 89% water leads to undesirable dilution in large quantities.

After preparing the various starch treated muds the pH's of the solutions were obtained with a Beckman pH meter, whereupon the muds were put in tightly sealed jars and maintained overnight at a temperature of 150 degrees Fahrenheit to approximate well conditions. This is a standard treatment which we give muds undergoing tests in our Baroid research laboratory. The next Dp. 73 day the muds were cooled to room temperature, the pH redetermined and also the viscosity determined on the Stormer viscosimeter and water loss determined on the standard American Petroleum wall building tester.

The detailed results are given on page 3 of the paper which counsel has handed me and show that in all three cases a substantial, marked reduction in water loss was brought about, with somewhere between one-half and one per cent of starch based on the weight of the mud. The pH's attained with the addition of one-half to one per cent of starch added ranged as between the different muds from a pH of 8.1 for the minimum and 10.6 for the maximum. The largest amount of starch added was 1.5 per cent, which in all cases resulted in a low water loss and gave pH's ranging from 9.4 to 10.9 after aging.

Q. Is that highest, 10.9, sufficient to keep the mud from fermenting? A. No, it is not.

Q. How high do you have to go in order to stop it? A. Above about 11.5.

Q. Then that is on a logarithmic scale? A. That is correct.

Q. So, it is not merely a difference between 10.9
Dp. 74 and 11.5, is it? A. No.

Q. There is a rapid increase, isn't there? A. Yes, there is a very great increase in the actual amount of alkali constituent.

Q. Now, referring again to "C", the Gulf Coast fresh water, suppose that had been a salt water mud, what would have been the highest pH, higher, or lower? A. It would have been lower.

Q. Now, in all those cases that you have there, the first, "A" and "B" where there was salt water there would be no fermentation, would there? A. No, those would have been preserved by the fact that the mud was substantially saturated with salt, although if a great deal of the drilling solution had been added the mud would no longer have been saturated.

Q. Now, if you take the fresh water mud though at 10.9 there would have been fermentation? A. That is correct.

Q. And was the procedure there with that fresh water mud any different than you have seen it performed in the field of making up your caustic starch solution and then putting it in the drilling mud? A. Well, I have only seen
the starch cooked up and added as a slurry to
Dp. 75 drilling mud where the drilling mud was satu-
rated with salt, so that "C" differs from ordinary
field practice in that the treating solution was added to a fresh water mud.

Q. But in the case where you use gelatinized starch, produced any way you want, and the pH is not carried up to 11.5 you say fermentation results? A. That is the case. The mud of "C" after a few days would have started to ferment.

Q. Now, if you look at Figure 3 of the application, in which you have a clay and even have calcium sulphate at a pH of 12 and using one and one-half per cent of starch, where is the water loss in that case? A. The water loss is about 4½ c. c.

Q. As distinguished from 6.2 of the Gulf Coast "C"? A. That is correct.

Q. Is that a difference? A. Although that is almost within experimental error, that is not a practical difference.

Q. But that particular drilling fluid contained calcium sulphate, which is gypsum, isn't that right? A. Yes; that is stated in the sub-title of Figure 3.

Q. Now, let's proceed. Did you see the Gray, Foster and Chapman paper when it came out in 1941? A. Yes, I did. I am a member and was also at the time of Dp. 76 the American Institute of Mining and Metallurgical Engineers, and I get their papers regularly.

Q. Were you still at that time struggling with the fermentation problem? A. Yes, in many types of muds.

Q. Did that teach you, did that paper teach you to carry the pH up to 12 in order to stop fermentation? A. No, it did not.

Q. Now, have you read the Cannon patent, on which the Examiner particularly relies, that is, No. 2,109,858?* A. Yes, I have.

Q. How soon did you see it after it issued on March 1, 1938? A. I saw the notice of it in the Official Gazette a week or two after it issued and obtained a copy immediately thereafter.

Q. Did you read it? A. Yes, I did.

Q. And that was in 1938? A. That is right.

Q. Before 1939 or 1940 when you really started your research on the starch for use in drilling fluid? A. That is correct.

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* Defendant's Exhibit A.

Dp. 77 Q. Did that Cannon patent teach you anything in solving the use of starch in drilling fluids? A. No, it did not.

Q. Does that Cannon patent mention gelatinized starch or colloid? A. No, it does not.

Q. It just mentions starch, does it? A. Just "starch".

Q. Do you know whether the Cannon method of that patent where he uses those large percentages of bentonite and Quebracho and caustic is being used today? A. It is not being used today, to my knowledge.

Q. Have you ever seen it used? A. No.

Q. The Cannon patent will show this fact, but Baroid Sales Company had a Bloxom application at that time which went into interference with the Cannon application; do you remember that? A. Yes, it was because of my familiarity with the Bloxom application that I paid particular attention to the Cannon patent when it appeared in the Gazette.

Q. The proceeding in that interference shows that your company and Bloxom abandoned the contest and didn't even cite it any more after the interference was declared, that is a fact? A. I believe it is.

Dp. 78 Q. Well, the records will show it, in the Cannon. Now, did you consider yourself that whole proposition to be of sufficient importance to go and fight an interference with the Cannon patent? A. No.

Q. But at that time your company had owned the Harth patent since 1935, isn't that right? A. That is correct.

Q. And later on, at least a year or two years after the Cannon patent issued, you started in on the research again on the use of starch and the result was fermentation, isn't that right? A. That is correct.

Q. And in 1943 Sikes and Beesley filed their application on the use of high pH of 12 in the use of starch and colloid? A. That is correct.

Q. Does the Cannon patent tell you anything about preventing fermentation? A. No, it doesn't.

Q. Does it mention the pH any place? A. No, it does not.

Q. Does it specifically give any example at all of the use of starch in connection with caustic in any of the
Dp. 79 examples? A. No, it does not appear to.

Q. What are all those examples from "Quebracho" down to "Sumac" on page 2, what are they, tannins? A. Those are all tanstuffs, that is, tanning extracts.

Q. He also mentions tannic acid, humic acid, pyrogallic acid and gallic acid on page 2 at the top, left hand side. If you put those in water are they solutions? A. Yes, they are solutions.

Q. If you react them with caustic soda what is the result, a solution, or a colloid, or a gelatinized colloid? A. You have got what is substantially a solution.

Q. And from your experience with this do you know whether or not all of those, the tannic acid, humic acid, pyrogallic acid, gallic acid, are either alone or in connection with caustic soda viscosity reducing agents? A. They are all viscosity reducing agents, in various degrees.

Q. Now, does the Cannon patent tell you anything about reducing the water loss to a formation except preventing shale from heaving? A. No, there is nothing in the Cannon patent directed to the matter of water loss reduction, that I can find.

Q. Now, in the Cannon examples on page 2 do you find any examples at all except in connection with a
Dp. 80 tannic acid, caustic and tannic acid? A. That is
all in connection with tannic acid; in fact, the particular tannate, Quebracho extract.

Q. But it might include one of those tannic acids given on page 2 at the left, is that it? A. Yes.

Q. Is starch a substitute for tannic acid? A. No. No, I can't think of any industry, in fact, in which starch would be a substitute for tannic acid.

Q. Now, the Examiner has taken this position, that if you take those Cannon examples and substitute starch for Quebracho extract that you will get a drilling fluid containing gelatinized starch, I suppose, although he don't say so specifically, in a drilling fluid at a pH of 12 and at an operative drilling viscosity. Have you made any experiments to determine that? A. Yes, I have. I have followed the examples of column two of page 2 of the Cannon patent as best I could, substituting starch for caustic soda, and in all cases I failed to obtain anything fluid enough to be usable as a drilling fluid.

Q. All right, you gave me a paper entitled "Bentonite Water Mixtures With Quebracho and Caustic Soda Starch and Caustic Soda."* What can you tell me about Dp. 81 that paper? Go through it from beginning to end. A. This paper describes experiments made under my direct supervision in Los Angeles in the laboratories of the Baroid Sales Division. I made up four mixtures, as I will describe shortly, using Quebracho extract, and then made another four in the same way except with the substitution of ordinary cornstarch for Quebracho extract.

Q. Now, to start with, is example A actually described in the Cannon patent? A. Example A is not explicitly described in the Cannon patent, but I took the example of page 2, column 2, lines 1 to 9 thereof, with the assumption that the example was for a drilling fluid itself, the balance not shown by the patent being water.

Q. Cannon don't tell you that, does he? A. Cannon doesn't say so, no.

Q. But you leaned over backwards to do that, didn't you? A. Well, I did what I could in view of the unexplicit character of the example. The result of this test is, of course, as (A) on the paper which counsel has handed me.

Then I took the directions of the Cannon patent on lines 11 to 15 of this same page 2, right column, where Cannon says that the concentration of caustic soda "must Dp. 82 exceed one-third of one per cent by weight of the drilling fluid" and made a change in the first mud along these lines, namely, that I used one-third per cent by weight of caustic soda instead of one per cent by weight of caustic soda as suggested by the first example. This mud is shown on the paper as (B).

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* Plaintiff's Exhibit 6.

I took the example of the Cannon patent page 2, right column, lines 36 to 44; this is (C) in the paper. Finally I took the example of the Cannon patent page 2, right column, lines 45 to 53; this is (D) on the paper.

All these muds were duplicated with starch instead of Quebracho as (a), (b), (c), (d), respectively.

The results show that mud (A) with Quebracho extract was apparently an operable mud, having a viscosity of 36 centipoises. On the other hand, the viscosity of the mud (a) where starch was used instead of Quebracho was too high to measure. The pH was high enough to gelatinize the starch; and the gelatinization of the starch was checked microscopically.

Mud (B), using Quebracho, gave a mud somewhat on the upper limit of operational viscosity; and had a pH of 10.32 and a viscosity of 150 centipoises, approximately. Mud (b), where starch was substituted for the Quebracho was too high in viscosity to be measured. Microscopic examination of the mud indicated that the starch
Dp. 83 was not gelatinized; I would attribute the high viscosity and plasticity of this mud to the fact that it contains somewhat more than 10% bentonite, which in the absence of a specific viscosity reducing agent is generally thickened by the addition of caustic soda. However, even a simple suspension of 10% bentonite in water would be too thick for use as a drilling mud.

Mud (C) where Quebracho was used was apparently an operable mud, having a viscosity of 82 centipoises, although the pH was rather high, namely, 13.10. Mud (c) containing starch instead of the Quebracho was a paste with too high a viscosity to measure.

Mud (D) with Quebracho was too thick for use as a drilling fluid, having a viscosity of about 200 centipoises, and the pH was very high, approximately 13.6. Mud (d) with starch instead of Quebracho was even thicker, the viscosity being much too high to measure on the Stormer instrument.

None of the starch muds, namely, (a), (b), (c), (d), could be used as a drilling fluid, because they were pastes rather than muds.

Q. Well, if you take those muds and thin them down with water what happens to Cannon's idea of keeping Dp. 84 shale from disintegrating? A. As I gather as best I can from Cannon's description, his idea is to "soak up" any excess water in the drilling mud with bentonite, so that adding water would appear to be moving in the wrong direction.

Q. It would defeat the very purpose of what he wanted to do, wouldn't it, to maintain it loaded up with solids, isn't that right? A. Yes, although I must admit that I am not completely clear as to what Cannon really wanted to accomplish.

Q. If he wanted to load it up with solids so the clay would not disintegrate, if that is possible, the thinning it with water would get it going in the opposite direction he wanted it to, wouldn't it? A. That is correct.

Q. Now, let's compare those (A), (B), (C), (D), where he used Quebracho, and (a), (b), (c), (d), where you use starches. Now, if you take, for instance, (B) and (b) using the same amount of bentonite, the same amount of caustic, the same amount of starch, you have got a difference in the pH, haven't you? A. Yes, the Quebracho extract is a weak acid and operates to neutralize a portion of the caustic soda and thereby lowers the pH.

Dp. 85 Q. And starch doesn't do that, starch is not an acid, is it? A. No, starch does not do that. The results of the very high pH's of muds (c) and (d) are a little irregular because such high pH's are difficult to measure with the glass electrode pH meter, as the alkali attacks the glass.

Q. Now, was there anything in any one of these tests (a), (b), (c) and (d) which showed that the pH might have been too high and affected the starch? A. Yes, it was observed with muds (c) and (d) that the filtrate from these muds was somewhat dark in color, as though the starch had been perhaps caramelized by the high alkalinity.

Q. A caramelized starch is still an emulsoid colloid? A. As caramelization of starch proceeds the starch becomes less and less of an emulsoid colloid.

Q. Let's take (B) of Cannon's proposition that the amount of caustic should be one-third by weight of the drilling fluid. (B) is okeh, isn't it? I think you said so. A. You mean, does it correspond to Cannon's?

Q. Well, I mean, is all right. A. Oh, as a mud, yes. It is a little thick.

Q. It is a little thick, but I mean, you have seen muds like that, haven't you? A. Yes.

Dp. 86 Q. And they have been used, haven't they? A. Yes.

Q. Now, if you take (b), for instance, where you substitute starch for Quebracho, as you said, you immediately get into something you can't use at all? A. That is correct.

Q. Now, in that one-third of one per cent weight of the drilling fluid and referring to your own experiments and also to the papers of Reychler and Ostwald, is that enough to gelatinize the starch? A. No, the pH in the mud having just one-third of one per cent caustic did not gelantinize the starch, which was confirmed microscopically and which is clearly explainable on the basis of the small amount of caustic added, which was further confirmed by the pH of the mud as measured.

Q. In other words, Cannon's signpost or yardstick as applied to one-third of one per cent by weight of the drilling fluid of the caustic applies okeh when you use Quebracho with caustic, doesn't it? A. That is right. There is no such thing with Quebracho or any of these other tanstuffs as a critical amount of caustic for gelatinization, because in the first place there is no such thing as gelatinization with the tanstuffs.

Dp. 87 Q. But I mean, it is all right as far as a guidepost where Quebracho is concerned, but as applied to starch the guideposts guide you wrong, is that right? A. That is a fair statement. Following the teachings of Cannon you might get gelatinization of starch, as for example in (a), but again you might not.

Q. (a) don't have any specific statement in the present case? A. No.

Q. The only three examples are (b) (c) and (d), aren't they? A. That is correct.

Q. Now, Mr. Cannon has repeated that signboard on mud, also on yardstick of one-third of one per cent by weight of the drilling fluid as to the caustic, one, two, three, four times on the right-hand side of page 2 and in claims 1 and 5, hasn't he? A. That is correct.

Q. And if somebody would follow that and use even something over one-third of one per cent in connection with starch would he go right, or would he go wrong? A. He would go wrong, unless he exceeded it a great deal, which would be purely fortuitous.

Q. But naturally a man wouldn't use any more than he has to use or directed to use, isn't that right?

Dp. 88 A. That is right, particularly with a caustic material such as caustic soda.

Q. It is a little expensive, isn't it? A. Well, it is not so expensive as it is difficult to handle and dangerous.

Q. Now, let's take (B) again and his one-third of one per cent using Quebracho extract. That won't ferment, will it, that drilling fluid won't ferment, will it, and it has Quebracho extract in it? A. No, not on these drilling muds with Quebracho and no starch.

Q. But if you take the guidepost as applied to substitution of starch for Quebracho extract will that ferment? A. No, the pH in that case is high enough to prevent fermentation, at least if that pH is maintained.

Q. But it will not be gelatinized starch? A. No, that is true.

Q. And you get your wall building properties and everything by your bentonite, don't you, in that case? A. That is true.

Q. Now, is it important to maintain that pH of a drilling fluid? A. Generally speaking it is always important to keep the pH of a drilling mud within bounds, but particularly when the Sikes-Beesley process is used it is Dp. 89 essential to keep the pH high enough to prevent fermentation. The necessity for constant watching arises from the fact that if unattended the pH will gradually drop, as I believe I stated earlier, did I not?

Q. Yes. Now, using the Sikes-Beesley process with the discussion given, what the fellow does is to make measurement of pH, doesn't he? A. That is correct.

Q. And if the pH drops below 12, or 11.7 I think like he said in the specification, then you add more caustic, don't you? A. That is correct.

Q. Then he watches the water loss, and if the water loss drops below what he wants, why, he adds more starch? A. That is correct.

Q. Does Cannon tell you anything like that? A. I don't see anything like that in the Cannon disclosures.

Q. Does Stern say in his February 1941 paper when he specifically refers to this Cannon patent, does he say that Cannon taught that, the high pH and high water loss and all that? A. No, it looks to me as though from the Stern paper he merely says that starch is good for salt water mud but in no other cases.

Dp. 90 Q. But in referring to the Cannon patent he don't even refer to salt water, does he, on the previous page he refers to the Cannon patent? A. That is correct. I see now that Stern does refer to both the Harth patent and the Cannon patent.

Q. Has Cannon presented any papers before the petroleum people, do you know? A. Yes, he has presented several.

Q. You have talked to him a lot, too, haven't you? A. Yes, I see him rather frequently.

Q. He knows about this high pH procedure now, doesn't he, Cannon? A. Oh, yes, very well.

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STIPULATION.

June 6, 1950.

It is stipulated by the parties to the above action, through their respective counsel, that the defendant shall have the right to object to any testimony taken at St. Louis, Missouri, on the grounds of incompetency, irrelevancy, or immateriality; and that the defendant shall further have the right to cross-examine any witness produced in Court on the subject matter of said testimony.

PLAINTIFF'S EXHIBIT 1.

Pending Application of
Dee A. Sikes and Jack H. Beesley,
Filed June 7, 1943, Serial Number 489,890,
for
Improvement in Treatment of Well Drilling Fluids.

(Cancellations by lining out.)

(Amendments in bold-face type.)

This invention relates to well **mud-laden** drilling fluids, as employed in the drilling (including coring) of wells, viz., oil and gas wells, whether drilled by the rotary or cable tool systems. **Such a drilling fluid, having a water as a phase, usually contains also a clayey component, either when made up, or when supplied in the course of drilling, from the formation being drilled or when added. Such a fluid may also contain a concentrated colloidal clay such as bentonite, fuller's earth, and/or a weighting material, such as barytes.** This invention is applicable to fluids whose aqueous phases are fresh and salt water and to cases where salt or salt water are encountered. This invention is also applicable where the drilling fluid is or becomes contaminated by other soluble or partly soluble substances which have a deflocculating effect on clay or other materials in the fluid.

This invention is an improvement on the Harth patent 1,991,637, granted February 19th, 1935. This Harth patent discloses the employment in drilling fluids of concentrated colloidal materials suitable and adapted for the particular dispersion medium of the fluid, and more particularly ~~emulsoid colloids,~~ **those materials having the characteristics of water-adsorption and swelling and designated in that patent as "emulsoid colloids"; one of such materials enumerated in the patent is starch.** ~~including starch.~~ It is obvious, of course, that in order for the starch to act as an emulsoid colloid, it should be in a gelatinized form. Starches may, in general, be gelatinized as early disclosed in the Marsden patent 376,445, granted January 17, 1888; this is attained by boiling the starch in water with or without an alkali, such as, caustic soda. An example of this is wheat paste, prepared from wheat flour, and which has long been used by paper-hangers. Moreover, starch has long been gelatinized by housewives when employed in cooking for the making of puddings, gravies, etc. In some cases preheating of starch for employment in a well-drilling fluid is not even necessary; because the temperature at the bottom of a deep well is frequently in the neighborhood of 180° F. and above; accordingly even dry ungelatinized starch, when added to a drilling fluid at the top of such a well, will become gelatinized at the bottom of the well. In shallow wells, however, where the temperature is not sufficiently high the practice has been to gelatinize or paste the starch before addition to the drilling fluid.

A form of starch which is **a colloid of the character described** ~~an emulsoid colloid~~ is a pregelatinized starch prepared by cooking the starch with water and drying it;

it may then be comminuted for addition to the drilling fluid in dry form; an example is cold water laundry starch which gelatinizes in cold water. Thin-boiling starch (prepared, for example, by mineral acid treatment) gelatinized by cooking with water, is useful for this purpose. All such starches are ~~emulsoid~~ colloids **of the character described** and more specifically are amylaceous or starchy colloids. Suitable for the practice of this invention are the gelatinized starches of corn, potato, tapioca, rice, arrowroot, sago palm, wheat, and the by-products of flour such as ship-stuff, shorts and middlings, etc.

Starch has been employed in well drilling fluids in which the aqueous phase was either fresh or salt water. In such cases it has been found that starch reduces the water loss markedly as compared to cases where clays, including bentonite and fuller's earth, were used as the fluid bases. In a drilling fluid, however, starch is subject to deterioration, apparently because of the presence of bacteria, yeasts or molds, or enzymes derived therefrom. These agents apparently split or break down the starch, sometimes resulting in a condition of fermentation or souring of the drilling fluid. This deterioration of the starch may disadvantageously affect the desired characteristics of the fluid; for water-loss increases rapidly as fermentation progresses, the fluid viscosity is disadvantageously affected, and a condition analogous to "gas cutting" may take place.

While in salt water of comparatively high salt content (over 15%), deterioration of the starch and fermentation are often retarded, and while common salt may be added to fresh water drilling fluids, this deterioration and fermentation are not effectively inhibited; moreover, the latter procedure requires large quantities of salt and is, therefore, expensive, while the brine has a corrosive effect upon the equipment and has an effect of flocculating the cheaper clay colloids employed. In drilling fluids employing starch, in an aqueous phase of fresh water, or salt water, particularly of lower salt contents, in the course of time, deterioration of the starch may, therefore, so progress as to require frequent additions of starch, and this can only be continued to a limited extent; for deterioration will sometimes proceed faster than the starch is added. What apparently takes place, is that the starch is converted to dextrines, sugars or other products, which are not only ineffective as sealing mediums, but dissolve in the aqueous phase and bring about a condition of fermentation. While many preservatives other than salt have been suggested, these have not been found to be entirely satisfactory, and moreover are liable themselves to disadvantageously affect the desired properties of a well drilling fluid.

Some of the objects of this invention, therefore, are to provide a treatment of well drilling fluids **of the character described** with starch or other amylaceous or starchy colloids, and a resulting well drilling fluid, whereby the above noted effects are **substantially** overcome.

Other objects are to provide a process and fluid which attain a substantial wall-seal of low water loss at an operable viscosity.

Further objects will appear from the detail description in which will be set forth a number of illustrative embodiments of this invention; it is to be understood, however, that this invention is susceptible of various other embodiments within the scope of the appended claims.

In the drawing, the figures are diagrams illustrating the effects and results of this invention. Figure 1 shows the results obtained when starch is added to a drilling mud consisting of a good average clay used for this purpose mixed with water, when the pH of the mud is brought to 12 prior to the addition of the starch. In using such a mud as the drilling fluid in a well sufficient alkali should be added from time to time to prevent the pH falling below this figure. The specific gravity of the drilling fluid was 1.2, i. e., it weighed 10 pounds per gallon (75 pounds per cubic foot, 420 pounds per barrel of 42 gallons). The drilling fluid in Figure 2 is substantially the same as that of Figure 1 with the exception that it contains salt (NaCl). The drilling fluid of Figure 3 is substantially the same as that of Figure 1 with the exception that the aqueous phase is fresh water saturated with calcium sulphate. The curves for muds of the type shown in Figure 2 are approximately the same regardless of the percentage of sodium chloride contained in the mud and the curves for the muds of the type of Figure 3 **(shown with lines connecting data points)** are approximately the same regardless of the percentage of calcium sulphate contained in the mud. Curves for muds containing magnesium chloride and calcium chloride vary slightly depending upon the quantity of contaminating substances present in the mud.

The starch employed in each case was the thin boiling starch previously described. The pH of the drilling fluid was maintained at about 12 by caustic soda (NaOH). When a drilling fluid employing bentonite or fuller's earth is used, the behavior is generally the same as shown.

We have **found** ~~discovered~~ that when the alkalinity of a drilling fluid **of the character described** is brought to and maintained at a sufficiently high pH, then such a fluid can have incorporated with it, starch or other amylaceous colloids, **to an amount sufficient to attain a substantial wall-seal of low water-loss and at an operable well-drilling viscosity,** without attendant deterioration of the colloid or fermentation of the fluid. We have also found that under such conditions, starch can be added to a much greater percentage than heretofore deemed possible, and that water-loss can be reduced to a very low point and indeed practically eliminated. ~~When starch is added to such a drilling fluid, the viscosity first actually decreases with the initial addition of starch to a certain point, and then slowly rises; the viscosity may, however, be controlled by the addition of clay colloids, such as bentonite, etc. and by the~~

~~addition of viscosity-reducing agents, such as caustic and tannin or polyphosphates. In accordance with this invention, when the drilling fluid is at a pH of 12, sufficient of a starchy colloid can be added to attain a substantial wall seal of low water loss and at an operable viscosity.~~ **As illustrated in Figure 3, when starch is added to the drilling fluid of the character described and maintained at a pH of about 12, the viscosity and gel strength first appear to decrease with the initial additions of the starch and then they appear to rise. The viscosity and gel strength may, however, be controlled: viz., to secure increase by the addition of clay colloids, such as bentonite, etc., and to secure decrease by the addition of viscosity-reducing agents, such as caustic and tannin or polyphosphates. In accordance with the illustrative embodiments of this invention, when the drilling fluid of the character described is maintained at a pH of about 12, sufficient of a starchy colloid can be added to attain a substantial wall-seal of low water-loss and at an operable viscosity and gel strength, as shown in the drawings.**

We have found that when the alkalinity of a well drilling fluid is established and thereafter maintained at a pH of about 12, then starch may be incorporated in such a fluid, and it will continue to function as a sealing medium without **substantial** deterioration or attendant fermentation. Moreover, we have found, that under such conditions, the water loss will decrease with additions of starch, to a point where it approaches zero water loss*, and all without **substantial** deterioration or fermentation, so that the low water loss is not only attained but is maintained. The above is not only true of a drilling fluid whose aqueous phase is fresh water, but salt water as well, and to a fluid whose solid phase is clay, bentonite or fuller's earth. This is illustrated in the drawing, which is self-explanatory.

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* Viz., the water loss in 30 minutes as determined in accordance with the American Petroleum Institute's "Standard Field Procedure for Testing Drilling Fluids"; see also "Drilling Mud" of May, 1940, pp. 4, etc.

~~The reason~~ **One of the reasons** for the advantageous effects, brought about by maintaining a drilling fluid at the above noted high pH, is believed to be due to the fact that the starch-splitting enzymes are rendered innocuous at a pH of about 12. While the bacteria are probably killed at a pH of somewhat below 12, this is not sufficient, for the enzymes apparently act as catalysts and may still remain effective. At a pH of about 12, the results seem to show that, in a drilling fluid, the enzymes are apparently rendered incapable of bringing about deterioration of the starch or fermentation of the drilling fluid. The pH may be slightly below 12, thus a pH of 11.7 is in many cases sufficient. The pH may also be above 12, although that requires rapidly increasing quantities of the alkali as the pH is increased. ~~as shown in the drawing.~~ We have, however, found that generally the pH should not be above 13.3, because it appears that above that point the starch tends to begin to become less effective.

The drilling fluid may be brought to the desired pH by any suitable alkali, as by the addition of caustic soda, caustic potash, caustic lithium, caustic ammonia, etc. Of these caustic soda is the most economical to employ. However, even lime ($Ca(OH)_2$) may be employed, particularly as soda lime, although lime is not as effective as caustic soda and its tendency is one moreover to flocculate the drilling fluid before starch is added. Soda ash (sodium carbonate—$NaCo_3$) may also be employed in connection with a caustic **in order to remove excessive amounts of other salts, as will be shown later.**

While the drilling fluid may be brought to the desired pH at any time, the better and more economical procedure is to attain a pH of about 12 before the addition of the colloid; for in that way not only will the starchy colloid be better utilized, but starch deterioration and attendant fermentation will be initially inhibited, so that less of the alkali and of the colloid will be required to give the desired result. A deteriorated drilling fluid may, however, be brought to the desired condition to stop and overcome fermentation, by the addition of the alkali, although in that case much more of the alkali and starch will be required. In any case the pH may thereafter be maintained by the addition of the alkali thereto. The alkali and starch may be added, preferably at the intake, although one or both may be added in the settling ditch and circulated.

The amount of alkali to be added initially, or later as the drilling proceeds, will depend upon the conditions encountered and the character of the fluid employed and of the formation being drilled. This will be clear when we consider that an alkali will also act upon salts contained in the aqueous and solid phases of the fluid and of the formation. While, therefore, no definite percentages can be prescribed, the amounts required may be readily determined. The pH of the fluid may be readily tested at any time to determine its condition. A number of pH meters and indicators are available. A suitable indicator is a solution of trinitrotoluene (TNT) in methyl alcohol which, at a pH of about 12, gives a dark red color when added to a drilling fluid containing clay, bentonite or fuller's earth. Any other suitable indicator such as Beckman pH meter may be employed. It will, therefore, be understood that where a pH of about 12 is designated, it will include determination by the various means described; generally stated it will include a pH which will inhibit deterioration of a starchy colloid in a well drilling fluid and prevent fermentation of the fluid.

With a drilling ~~mud~~ **fluid of the character described** maintained at the pH of about 12, a colloid employed, such as starch, as heretofore described, is added until the water loss is reduced to the desired minimum, which may be determined by testing the fluid initially and periodically by a filter press of which a number are available.* The results of such a procedure are shown in the drawing, from which it will be seen that by this method, with the addition of starch (to a fluid maintained at a pH of about 12) the water loss first decreases rapidly and then more slowly. **For example, in the Figure 3 illustration, at a water-loss of about 15 c.c., the reduction of viscosity is apparently at a minimum, and at a water loss of about 5 c.c., the viscosity has apparently risen with further additions of starch.** This drawing, however, shows generally the amount required to attain a desired water loss. **In the Figure 3 illustration, the addition of about 7 pounds of starch per barrel (42 gallons) of the fluid, maintained at a pH of about 12, attains a water-loss of about 5 c.c. at an operable well-drilling viscosity of about 30 centipoises.** ~~In accordance with this invention,~~ **As shown in Figure 3,** starch to the amount exceeding **7 pounds per barrel** ~~3%~~ and even to ~~6% of the weight~~ **21 pounds per barrel** of the drilling fluid may be readily added when the fluid is maintained at a pH of about 12. **As shown in the Figure 3 illustration, with such a high amount of added starch, the water-loss will be reduced to a low point but with the drilling fluid at an operable well-drilling viscosity and gel strength.**

In accordance with this invention a water loss approaching zero may be attained, and in practice a water loss of 0.5 cc (30 minutes) has been attained, and a water loss below 3 cc (30 minutes) is readily attained. As will be seen from the drawing, the amount of starch required to secure resultant decreases in water loss, increases rapidly below 10 cc, so that economic considerations govern the end to be attained. In general, however, the attainments of a water loss of less than 5 cc is highly desirable. A low water loss is very important in modern well drilling, even where the aqueous phase of the drilling fluid is fresh water. Thus in coring, a substantially zero water loss enables the taking of a core, which will accurately present the oil and gas content of the formation. In drilling through heaving shale, such a low water-loss drilling fluid inhibits hydration of the shale. In general the low water-loss drilling fluid described will reduce passage of water to a producing formation to practically zero, will prevent flooding of a producing formation and form a thin filter cake and so avoid sticking of the drill pipe.

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* See Drilling Mud of May, 1940, pp. 4 etc. describing the above procedures.

Because of the fact that amylaceous colloids, such as starch, etc. are particularly effective when employed with **the drilling fluid maintained at a pH of about 12** ~~a high pH,~~ these may be employed in the treatment of cement-cut muds; for the presence of the cement will not now be harmful but beneficial, because of the elevation of the pH by the cement. In such a case the additional starch **may** ~~will actually~~ result in the thinning of the **drilling fluid** ~~mud for the reason that, as noted above,~~ the first addition of starch **resulting** ~~results~~ in a progressive decrease of viscosity when added to an already alkaline drilling fluid, followed by a rise in the viscosity with the successive additions of starch. In such a case **the desired pH** ~~the desired results~~ can be obtained by adding additional alkali in order to attain a pH of about 12. A cement cut mud may, therefore, be corrected by the addition of starch, where required, and of additional alkali. Moreover, when the above high pH mud containing starch is employed while drilling through cement, the cement will not disadvantageously affect the fluid.

Where gypsum or anhydrite is encountered in drilling, the presence of the alkali will convert the calcium sulfate to calcium hydroxide and sodium sulfate as follows:

$$CaSO_4 + 2NaOH \text{ ——— } Ca\,(OH)_2 + Na_2SO_4$$

In the resulting compounds the lime is useful in maintaining alkalinity, although slightly decreased as compared to caustic soda. This invention is also useful where the drilling fluid contains or entrains sulphides, without or with lime or cement or all of them.

Where, in performing the process in the manner described, the viscosity and/or gel strength of the drilling fluids is not that desired, ~~It sometimes happens that by performing the process in the manner described by the employment of starch in a drilling mud of high pH, there will be a reduction in viscosity and/or gel strength. In such cases,~~ these can, if necessary, be restored or brought to the desired value by the addition of bentonite or fuller's earth or a good clay. Additions of sodium carbonate and sodium bicarbonate are, in many cases, also useful to improve the drilling fluid.

In general, the procedure employed will depend upon circumstances. Where the drilling fluid is one in which the solid phase is clay, bentonite or fuller's earth, with or without a weighting material, such as barytes, the preferred procedure is one to first add an alkali to establish a pH of about 12. Starch is then added until the desired low water-loss is attained, with addition of alkali when necessary to maintain the pH. Where necessary a clay colloid is added to secure the desired viscosity and gel strength, and where necessary the viscosity is further controlled by the addition of caustic and tannin or of a polyphosphate. There should, of course, be observations of the pH and water loss as the drilling proceeds, with additions of alkali and starch when required to maintain the pH at about 12 and to maintain the low water-loss.

The type of viscosity of fluids or muds **of the character described and** containing an appreciable quantity of starch is quite different from the type of viscosity encountered in other drilling fluids. In high pH muds to which starch is added the viscosity approaches more nearly a true viscosity, whereas, the so-called viscosity of ordinary drilling fluids is primarily a measure of the shear. ~~High pH~~ **Such high** starch fluids having a Stormer viscosity of 120 centipoises are still very thin, fluid and readily pumpable, whereas, with ordinary drilling fluids the upper allowable limit is a Stormer viscosity of about 50 centipoises. The difference in viscosity is more noticeable even on the Marsh funnel test than it is on the Stormer viscometer. For example, the upper limit of viscosity on an ordinary clay drilling fluid is perhaps 60 seconds on the funnel viscometer, whereas, a starch fluid having a viscosity of 90 centipoises is still almost as fluid as water. The important difference between ~~the~~ **such a** high pH starch fluid and the ordinary clay fluid is the starch fluids have a very low initial gel. Sodium bircarbonate can be added to **such a** high pH starch fluids to increase the initial gel strength if necessary. This increase in gel strength is obtained with a very slight increase in viscosity. To increase the viscosity of **such a** high pH starch fluids, fuller's earth can be added. This is also true of salt water fluids. When **such a** ~~the~~ high pH ~~of~~ starch fluid~~s~~ is obtained by the use of caustic soda the initial gel strength of the original fluid is substantially lowered.

While this invention is particularly applicable to the drilling of wells by the rotary system of drilling employing a circulating drilling fluid, it is also applicable to cable tool drilling. In both cases, a low water-loss is desirable, not only while drilling, but while coring. This invention is applicable to the drilling of wells or bore-holes generally, including the drilling of test holes preliminarily for exploration. This invention is applicable not only to drilling fluids in which the aqueous phase is fresh water but salt water and even when the salt content exceeds 15%.

Claims.

(These are set out in Patent Office letter of August 23, 1946, pages 212 to 214, infra.)

PLAINTIFF'S EXHIBIT 1-A

FIG. 1.

CLAY (Sp.Gr. 2.5)+H_2O

pH APPROXIMATELY 12 ESTABLISHED WITH NaOH

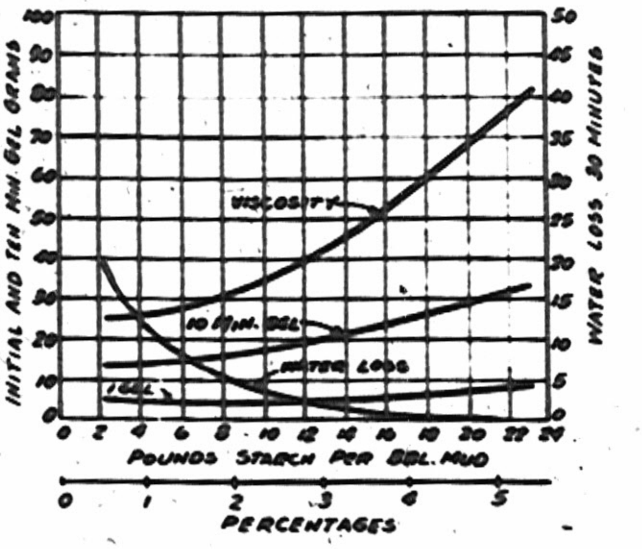


FIG. 2.

CLAY (Sp.Gr. 2.5)+H_2O+NaCl

pH APPROXIMATELY 12 ESTABLISHED WITH NaO

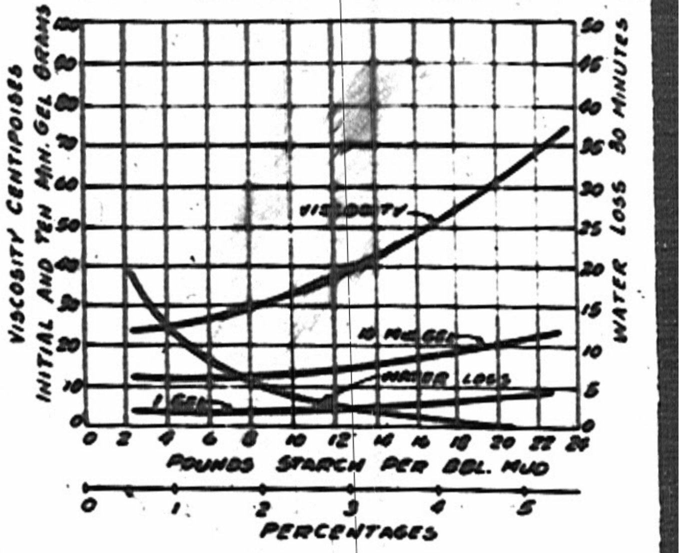
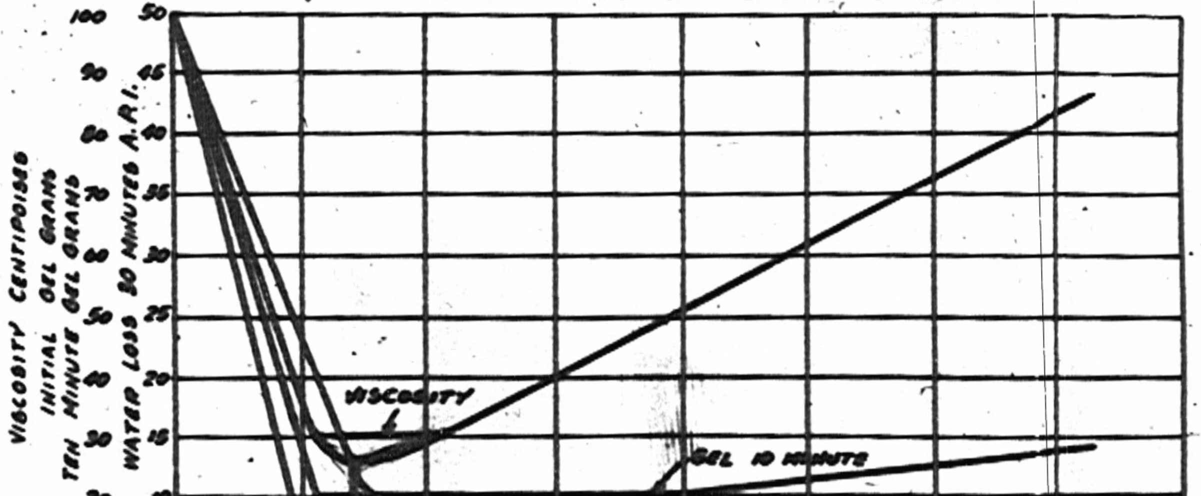


FIG. 3.

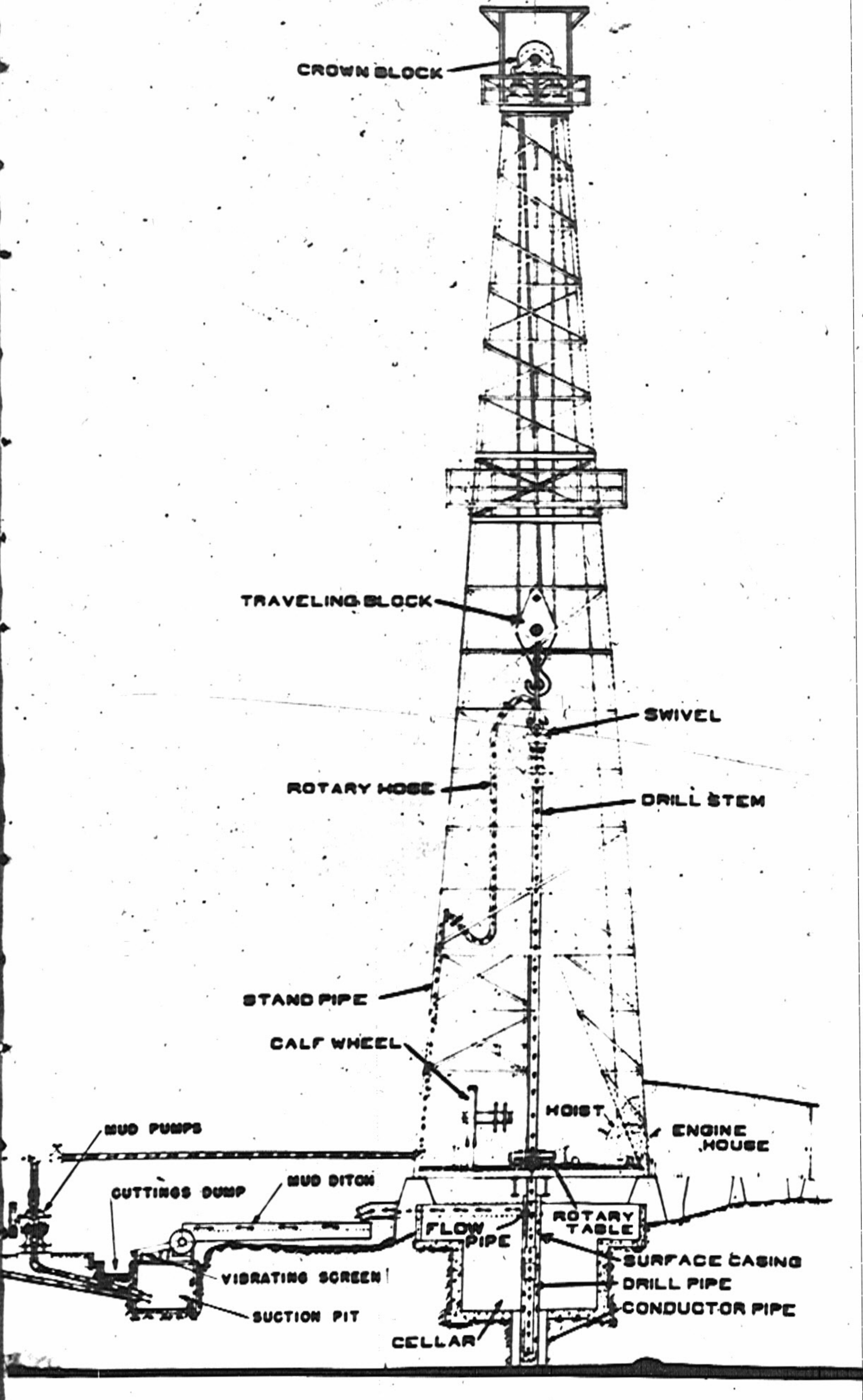
CLAY (Sp.Gr. 2.5)+H_2O+$CaSO_4$

pH APPROXIMATELY 12 ESTABLISHED WITH ADDITIONS OF NaOH



INVENTORS;
DEE A. SIKES,
JACK H. BEESLEY,
BY Bruninga & Sutherland
ATTORNEYS.

PLAINTIFF'S EXHIBIT 2



TYPICAL SE
OF WEL

PLAINTIFF'S EXHIBIT 3.

Affidavit of John F. Dodge.

State of California }
County of Los Angeles } ss.

John F. Dodge, being duly sworn, deposes and says as follows:

I am a graduate of the University of California College of Mining, Bachelor of Science in Mining Engineering, 1912; University of Southern California, Master of Science in Chemistry of Petroleum, 1915; Professional Degree of Mining Engineer, University of California, 1924. At present and since 1929 I am and have been Professor of Petroleum Engineering and Chairman of the Division of Petroleum Engineering, University of Southern California. The last thirty years I have been engaged in Petroleum Engineering in California, Texas and other parts of the world, and particularly since 1925 I have been engaged in research and Field Application of studies of drilling muds. The practical application of the principles of drilling muds was also included in my previous experience, where I rose to Engineer in Charge of Development, both in the Gulf Coast and in California, in drilling operations.

Importance of the Use of Low Water-Loss Mud.

The importance of the use of low water-loss mud in drilling and completion practice of oil wells may be considered in relation to at least three major effects on the results obtained, as follows:

(1) Effect on the drilling operation itself.

(2) Effect on the productivity of the reservoir sand.

(3) Effect on fluid content of the sands immediately adjacent to the hole and on cores taken with resultant effect on accuracy of conclusions as to probable productivity of sands penetrated.

Low Water-Loss Muds in Drilling Operation—Due to the more or less direct relationship obtaining between water-loss and thickness of cake built up on the wall of the hole, the use of low water-loss drilling fluids of the kind under discussion results in the deposition of extremely thin but relatively impermeable cakes, thus minimizing reduction of hole diameter. A high water-loss mud which deposits a thick cake reduces the effective area for circulation of drilling fluid, thus increasing pump pressures or reducing circulation rates for any given available pump pressure. Drilling is thus slowed down due to incomplete removal of cuttings from the well bore, tools become stuck more readily and greater difficulty is experienced in coming out or going into the hole. In many instances, with the use of poor muds, it is necessary to ream down or circulate down by stages in order to get the tools back on bottom, with the resultant loss in effective drilling time. The use of a low water-loss mud, on the other hand, allows the tools to be run to bottom without delay.

Thick mud cakes also give great difficulty in coming out of the hole due to a swabbing effect by tool points, drill collar, bits, and particularly drill pipe protectors or stabilizers. Portions of the cake are swabbed off from the wall of the hole, interfering with the removal of the tools and impeding circulation when drilling is resumed after the bit is again on bottom. Low water-loss muds with thin cakes give very little trouble due to swabbing. A further factor worthy of mention is the relative ease of recovery of lost tools after a drill pipe failure or twist-off. Low water-loss muds with thin wall cakes facilitate the recovery of the fish by minimizing difficulties in getting over the fish and recovering it from the hole.

Low water-loss muds with their thin wall cakes facilitate the running of casing, cementing operations, the landing of liners, and the bringing in of the well since there is relatively little cake material behind the pipe to clog perforations and reduce the effectiveness of the perforated liner or screen pipe. Poor muds of high water-loss slow down drilling operations and therefore multiply the damage out of proportion to their water-loss rate.

Effect on the Productivity of the Sand—Loss of water to the sand being penetrated by the bit results in the hydrocarbons in the pore spaces of the sand being driven back into the formation a distance proportional to the water lost by the drilling fluid during the time the sand is exposed to its action. The invasion of the sand is therefore a function of the rate of water-loss in a given time multiplied by the time of exposure.

The water which invades the sand not only has to be removed before the oil or gas can enter the well but in many instances seriously and permanently affects the permeability of the sand to oil and gas, thus reducing the productivity of the well.

This is particularly true of sands of low permeability which contain clay particles disseminated throughout the reservoir sand. Chemical and physical changes in the structure of these clay particles are effected by the fresh water from the drilling fluid, resulting in swelling of the clay particles and irreparable damage to the reservoir sand.

Instances are on record where wells have produced as much as 1100 barrels per day on test, and when finally completed after some days' or weeks' exposure to high water-loss muds, fail of any production whatever due to damage to the sands by invasion of water from the drilling fluid.

The use of low water-loss muds is considered to be of paramount importance in many of the deep fields of the

San Joaquin Valley in California and in Eastern Venezuela, where the reservoir sands carry appreciable amounts of bentonitic clays, but damage is not confined to sands of this character alone. Both laboratory tests and field experience demonstrate the superior productive capacity of wells completed with low water-loss muds, even in sands of relatively high permeability and freedom from contamination by clay or other unstable minerals.

Effect on Testing Results—The invasion of the formation by excessive amounts of water from the drilling fluids affects the resistivity and self-potential values of the electric log, giving rise to difficulty in interpretation and frequent erroneous conclusions. The so-called deep penetration or lateral penetration curve of some electric logs has been developed in an attempt to escape from this difficulty, but its correlation with ordinary resistivity curves is difficult and uncertain.

Excess amounts of drilling water in the formation give rise to erroneous conclusions in many instances in drill stem formation tests. The fluids which enter the hole and are caught and sampled are those adjacent to the well bore, and failure of conclusive tests because of drilling water contamination are very frequent where high water-loss muds are used.

Finally, the determination of the probable fluid content of the formation by analysis of core samples is rendered difficult, if not completely unreliable, when high water-loss muds are employed in coring. The use of low water-loss muds reduces the flushing effect while the core is being cut and minimizes the contamination of the core by the drilling fluid.

In each of the above-mentioned instances more dependable information as to reservoir characteristics and probable fluid content is obtained by the use of low water-loss muds and the danger of financial loss from wrong conclusions as to conditions obtaining in the reservoir reduced proportionally.

The Subject Matter Here—

I am familiar with the procedure of drilling wells by the employment of an aqueous well-drilling fluid or mud, comprising, bringing and maintaining the fluid to a pH of about 12, and adding to the fluid sufficient of a starchy colloid to attain a substantial wall-seal of low water-loss, viz., below 5 c. c. (A. P. I.) and at an operable well-drilling viscosity. This procedure, to my knowledge, is something entirely new in the art and has gone into wide use and has been found highly successful. The atttainment of a water-loss as low as 5 c. c. is important in order to attain the objects and results previously noted by me.

I am familiar with the Bureau of Mines report on investigations, R. I. No. 356, February, 1941, and particularly pages 76-77, relating to the employment of starch, with reference to the following statement in that publication:

> "It is only recently that starch has found application in drilling muds as a result of the development that hydrolyzed starch imparts a good filter test to salt-water mud. For this purpose the starch may be hydrolyzed by boiling a 10 percent starch suspension in sodium hydroxide (1 percent by weight; or starch: sodium hydroxide 10:1). A pH of about 11 or 12 has been found desirable" (p. 77).

That statement does not teach me, and did not teach me at the time that I read it, that the drilling mud or fluid itself was to be maintained at a pH of 11 or 12. Furthermore, that publication does not disclose the employment of sufficient starch to a drilling fluid or mud, brought to or maintained at a pH of about 12, in order to attain a substantial wall-seal of low water-loss, viz., below 5 c. c. (A. P. I.) at an operable well-drilling viscosity.

John F. Dodge.

Sworn to and subscribed before me this 25th day of August, 1945.

My commission expires July 27, 1948.

A. S. West,
(Seal) Notary Public.

PLAINTIFF'S EXHIBIT 4.

Raw Starch Treated With Caustic Soda NaOH and Hydrated Lime $Ca(OH)_2$.

	Additive	Grams*	pH	Viscosity	Initial Clarity	Settling After 30 min.	Settling After 18 hrs.	Appearance of Liquid After 18 hrs.
1.	None	..	5.9	1.0	Milky	Settled out	Settled out	Clear
2.	NaOH	0.1	12.0	1.3	Milky	" "	" "	"
3.	"	0.5	12.5	2.6	Milky	" "	" "	Very slightly turbid
4.	"	1.0	12.6	39.4	Translucent	No settling	No settling	All translucent
5.	"	2.0	12.7	15.4	Translucent	" "	" "	" "
6.	$Ca(OH)_2$	0.1	12.0	1.0	Milky	Settled out	Settled out	Clear
7.	"	0.5	12.4	1.0	Milky	" "	" "	"
8.	"	1.0	12.4	1.1	Milky	" "	" "	"
9.	"	2.0	12.4	1.1	Milky	" "	" "	"

---

* Grams additive added to 100 cc. distilled water containing 3.0 grams cornstarch
NaOH = Caustic Soda
$Ca(OH)_2$ = Hydrated Lime
Water = 100 cubic centimeters distilled water
Viscosity = centipoises by Stormer viscosimeter at 600 revolutions per minute
pH = alkalinity by Beckman pH meter

PLAINTIFF'S EXHIBIT 5.

Stern Bureau of Mines, February 1941.

Gray, Foster and Chapman Paper, February 1941.

Extract From Stern, February 1941, Page 77.

"It is only recently that starch has found application in drilling muds as a result of the development that hydrolyzed starch imparts a good filter test to salt-water mud. For this purpose the starch may be hydrolyzed by boiling a 10-percent starch suspension in sodium hydroxide (1 percent by weight; or starch: sodium hydroxide 10:1). A pH of about 11 or 12 has been found desirable."

Extract From Gray, Foster & Chapman Paper, February 1941, in Petroleum Development & Technology, A. I. M. M. E., Entitled "Control of Filtration of Salt Water Muds."

"A practical suspension for addition to drilling mud contains 10 per cent by weight of starch and 1 per cent of caustic soda." p. 5.

"Starch was intimately mixed with water by adding the starch through a mud-mixing hopper. Caustic soda was added, and the while, pasty mass was agitated with steam until a viscous, straw-colored suspension resulted. The final composition of the mixture was approximately 89 per cent water, 10 per cent cornstarch and 1 per cent caustic soda. The mud in the pit was stirred vigorously with the guns while the starch suspension was added." p. 7.

Tests in Accordance With Stern and Gray, Foster and Chapman.

In these tests ordinary cornstarch (Kingsford's) was made into a treating slurry by taking 1 part of caustic soda, 89 parts of water, and 10 parts of cornstarch, and passing live steam therein until the color became like straw. This procedure took about 30 minutes, but the total increase in weight of the whole slurry was only about 1 per cent arising from the condensation of the steam. The pH of this starch solution before heating was 12.7, and after passing the steam it was 12.5, as measured with a glass electrode pH meter. Several muds were made up as follows:

(a) El Paso clay, which is a commercial well drilling clay mined near El Paso and sold in West Texas, was made into a mud with saturated salt water in the proportion of 20 grams clay and 80 grams brine.

(b) Ada clay, a clay produced near Ada, Oklahoma, and at one time widely sold for use in drilling muds, was made into a mud using saturated salt water in the proportion of 20 grams clay and 80 grams brine.

(c) A mud taken from a well being drilled near Houston, Texas, and consisting mostly of drilled up shales in relatively fresh water was diluted with fresh water to a suitable consistency and tested, and was found to have at this consistency 17.5 percent solids by evaporation.

To each of these muds were added portions of the steam-treated caustic-starch solution, in such proportions as to give 0.2, 0.3, 0.5, 0.7, 1.0, and 1.5 percent by weight of starch in mud, which is the same basis of measurement as used in Figure 7 of the Gray, Foster and Chapman article hereinabove referred to. The viscosities (Stormer 600 r. p. m.), pH (by glass electrode Beckman instrument), and water losses (by the A. P. I. filtration method) were determined on each of the samples:

Mud	% by Wt. Dry Starch in Mud	pH Before Aging	pH After Aging	Visc. CPE. Stormer	Water Loss A.P.I. c.c.
(a)					
El Paso—salt	0	7.4	7.3	5	104
	0.2	8.2	7.7	5	132
	0.3	8.5	7.9	6	128
	0.5	8.9	8.1	6	72
	0.7	9.1	8.2	6	24.1
	1.0	9.4	8.5	6	12.6
	1.5	10.1	9.4	9	7.2
(b)					
Ada—salt	0	7.1	7.1	4	121
	0.2	8.1	7.5	5	190
	0.3	8.6	7.9	5	193
	0.5	9.1	8.2	4	40
	0.7	10.0	9.1	5	12.9
	1.0	10.5	9.7	5	9.1
	1.5	11.2	10.8	8	6.7
(c)					
Gulf Coast—Fresh water	0	...	9.0	2	20.3
	0.2	...	8.9	4	16.3
	0.3	...	9.3	4	12.5
	0.5	...	9.8	4	10.0
	0.7	...	10.1	5	9.1
	1.0	...	10.6	4	8.0
	1.5	...	10.9	6	6.2

PLAINTIFF'S EXHIBIT 6.

Bentonite-Water Mixtures With Quebracho and Caustic Soda, Starch and Caustic Soda.

(A) 1 gram caustic, 88 c. c. water; pH 13.08. Added 1 gram quebracho extract; pH 12.92. Added 10 grams Wyoming bentonite; pH 12.75 and viscosity 36 cpe.

(B) 0.33 grams caustic and 89 c. c. water; pH 12.67. Added 1 gram quebracho extract; pH 11.98. Added 10 grams bentonite; pH 10.32. Viscosity 150 cpe. approximately.

(C) 2 grams caustic, 76 c. c. water; pH 13.40. Added 2 grams quebracho extract; pH 13.21. Added 20 grams bentonite; pH 13.10. Viscosity 82 cpe.

(D) 7 grams caustic, 61 c. c. water; pH 13.72. Added 2 grams quebracho extract; pH 13.59. Added 30 grams bentonite; pH 13.60. Viscosity 200 cpe. approximately.

(a) 1 gram caustic, 88 c. c. water, 10 grams bentonite; pH 12.97. Added 1 gram starch; pH 12.97. Viscosity too high to measure.

(b) 0.33 grams caustic, 88 c. c. water, 10 grams bentonite; pH 12.43. Added 1 gram starch; pH 12.32. Viscosity too high to measure.

(c) 2 grams caustic, 76 c. c. water, 20 grams bentonite; pH 13.24. Added 2 grams starch; pH 13.20. Viscosity too high to measure.

(d) 7 grams caustic, 61 c. c. water, 30 grams bentonite; pH 13.61. Added 2 grams starch; pH 13.53. Viscosity too high to measure.

Caustic = Caustic Soda—NaOH.
Quebracho Extract = Tannic acid.
Starch = Corn starch—ungelatinized.
Bentonite = Wyoming Bentonite, a sodium bentonite.
pH = Alkalinity by Beckman pH meter.
Viscosity = centipoises by a Stormer Viscosimeter at 600 revolutions per minute.
c. c. = cubic centimeters.

PLAINTIFF'S EXHIBIT 7

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS
Technical Publication No. 1351
(CLASS G, PETROLEUM DIVISION, NO. 141)

DISCUSSION OF THIS PAPER IS INVITED. Discussion in writing (2 copies) may be sent to the Secretary, American Institute of Mining and Metallurgical Engineers, 29 West 39th Street, New York, N. Y. Unless special arrangement is made, discussion of this paper will close Dec. 1, 1941. Any discussion offered thereafter should preferably be in the form of a new paper.

Control of Filtration Characteristics of Salt-water Muds

BY G. R. GRAY,* MEMBER A.I.M.E., J. L. FOSTER* AND T. S. CHAPMAN*

(New York Meeting, February 1941)

The wall-building properties of salt-water drilling muds can be improved markedly by the addition of: (1) natural gums, such as tragacanth, karaya, and ghatti; (2) seaweeds, such as Irish moss; or (3) gelatinized starch. Results of laboratory tests have been confirmed by field trials. For drilling operations in which the mud becomes contaminated by salt, either through penetrating salt-bearing rocks or by addition of sea water to the mud, the added cost resulting from the use of one of the substances listed above is more than offset by freedom from stuck drill pipe and ease in running casing.

INTRODUCTION

It has been recognized for many years that oil production might be seriously hampered by infiltration of water from the drilling mud.[1-4] As knowledge of the mechanism of the wall-building process advanced, methods were developed for evaluating the filtration characteristics of muds.[5-11]

The wall-building properties of fresh-water muds are commonly regulated by the addition of bentonitic clays, or of agents to promote the dispersion of the natural mud solids. When strata bearing soluble salts are encountered in the course of drilling, the salts are incorporated in the mud; the clay solids are flocculated and water loss is increased tremendously. Methods generally used in controlling filtration of fresh-water muds are no longer applicable.

The problem of reducing water loss from salt-water muds is not confined to any particular area, but is acute in parts of West Texas. Salt beds several hundred feet thick must be penetrated before the oil-bearing formation is reached. Since the formation drilled does not provide mud-making material, it is necessary to use large quantities of commercial clays, and even the best commercial clay does not afford relief from the problem of high filtration.

A laboratory study has been made of methods of improving the filtration characteristics of salt-water muds, and some of the methods have been used in field practice.

LABORATORY INVESTIGATIONS

Procedure

Inasmuch as the immediate object of the investigation was the development of means of improving the wall-building properties of muds used in West Texas, an attempt was made to employ muds in the laboratory study comparable to those in field use. Samples of muds used in drilling the producing formations in six wells were secured. The properties of these samples are summarized in Table 1, which lists the densities, viscosities, filtration, and analyses of the filtrates for calcium, chloride, and sulphate. Viscosity was measured in the Stormer viscosimeter at 600 r.p.m. Water loss was determined at 80°F. with the Baroid low-pressure wall-building tester[8] at a pressure of 100 lb. per sq. in. Filtration rates are considerably higher than those of usual fresh-water muds, which amount to about 20 c.c. in 30 min. Water loss was so rapid in samples 4, 5 and 6 that filtration was complete in less than 10 min. and the values for 30 min. were extrapolated from the rates at shorter

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Manuscript received at the office of the Institute Jan. 30, 1941.

* Humble Oil and Refining Co., Houston, Texas.

[1] References are at the end of the paper.

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PETROLEUM TECHNOLOGY, September 1941. Printed in U.S.A.

times. Inquiry revealed that in accordance with common practice lime had been added in the preparation of muds 4, 5 and 6.[1] Subsequent tests showed that definite injury to wall-building properties of mud resulted from the addition of as little as 0.1 per cent of lime.

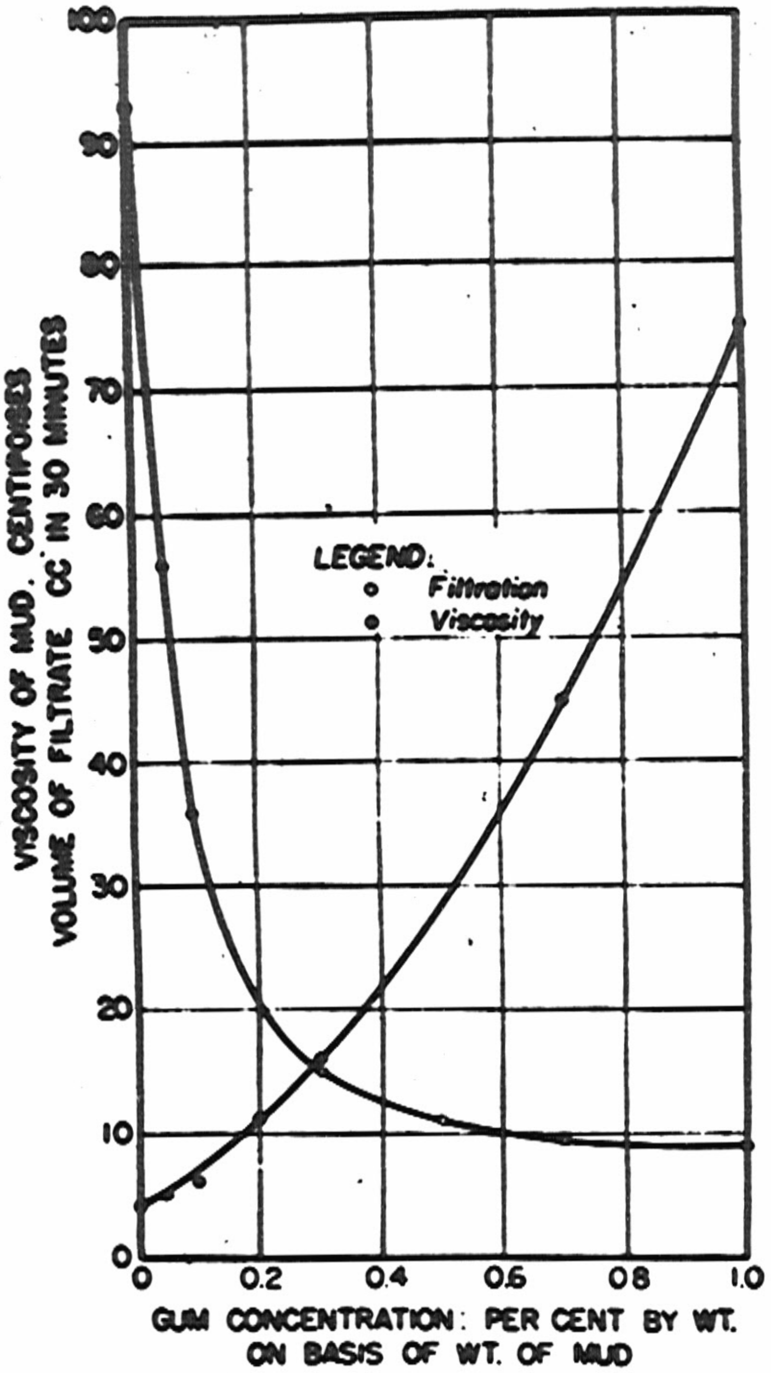


FIG. 1.—EFFECT OF TRAGACANTH GUM ON FILTRATION AND VISCOSITY OF 20 PER CENT SHAFTER LAKE CLAY IN SALT SOLUTION.

It was inconvenient to secure field muds for all laboratory tests. Muds were prepared in the laboratory as needed from commercial surface clays available in West Texas. The salt solution used in many of the tests contained 80 grams of sodium chloride, 12 grams of calcium chloride, and 2 grams of calcium sulphate per liter. This composition was approximately that of the average of a number of field water samples.

Other tests were made using a saturated solution of sodium chloride. Muds were prepared by dispersing with a high-speed stirrer 60 grams of clay in 240 grams of salt solution to which the agent under investigation was added. After they had stood overnight, samples were stirred thoroughly, the viscosity was measured, and the mud was transferred to the wall-building tester. The filtration was expressed as the cumulative volume of filtrate at the end of 30 min., corrected for drainage.

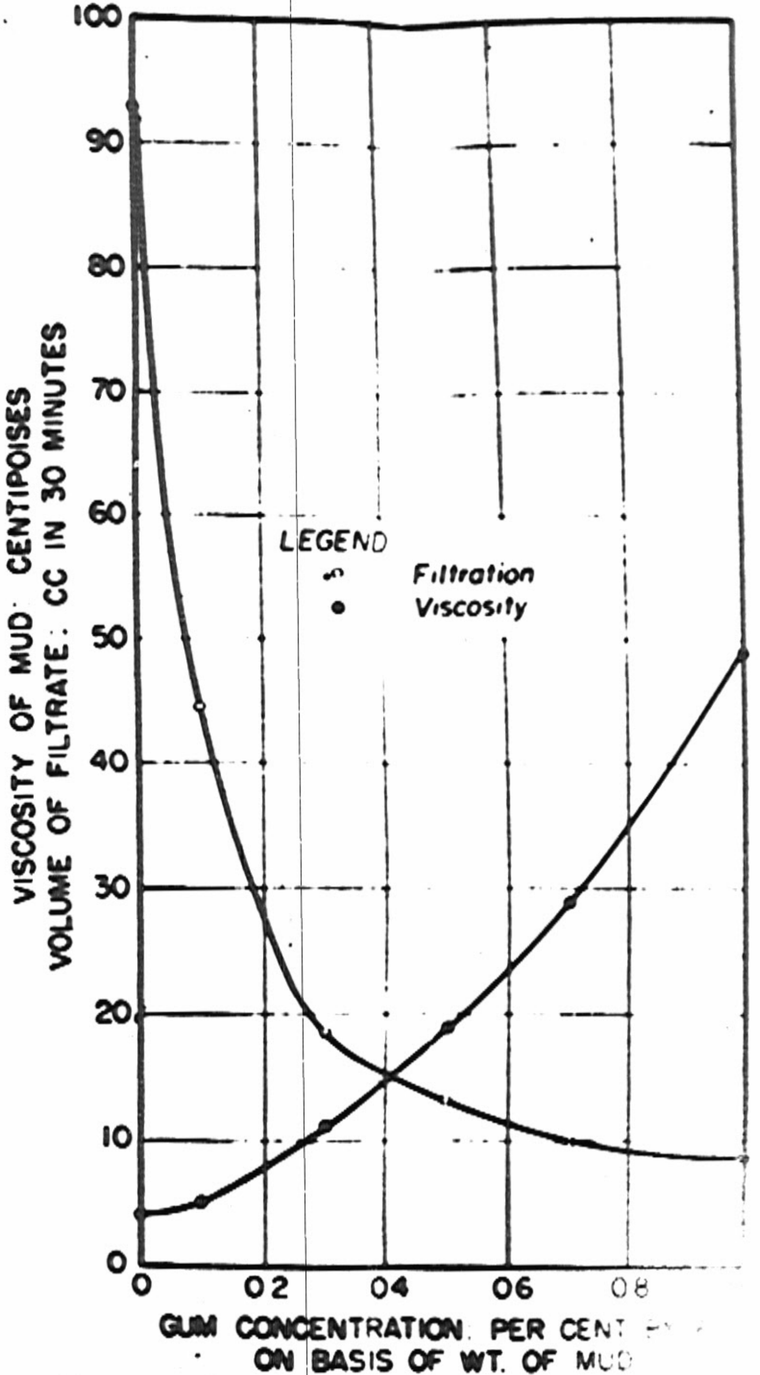


FIG. 2.—EFFECT OF KARAYA GUM ON FILTRATION AND VISCOSITY OF 20 PER CENT SHAFTER LAKE CLAY IN SALT SOLUTION.

Addition of Gum

One of the first substances that brought about a marked improvement in the wall-building properties of salt-water muds was

tragacanth gum. Other natural gums that swell in water were also found to be effective. Among these were arabic, ghatti, karaya, and locust bean. Gums consist essentially of carbon, hydrogen and oxygen, with a small amount of mineral matter. They are made up of sugars chemically united with an acid nucleus. Natural gums occur as exudates on the trunks and stems and in the kernels of various trees and shrubs. The natural products are sorted on the basis of trade standards and are milled to produce a variety of grades. Only the least expensive grades were investigated for use in drilling muds.

Laboratory tests were made on many samples of gums in a variety of salt-water muds. The results shown in Figs. 1, 2 and 3 are typical. Fig. 1 shows the effect of tragacanth gum on the viscosity and filtration of a 20 per cent suspension of Shafter Lake clay in a salt solution of the composition given above. The water loss decreases rapidly with small additions of gum from an original value of 93 c.c. in 30 min. to 10 c.c. after the addition of 0.2 per cent of tragacanth gum. Mud containing 0.5 per cent of gum has a water loss of only 11 c.c. But little further reduction is secured on increasing the concentration to 1 per cent. Viscosity of the mud increases continuously from 4 to 75 centipoises on the addition of 1 per cent tragacanth gum. Essentially the same behavior is shown for karaya gum in Fig. 2. Other tests showed that the effectiveness of tragacanth and karaya gums in reducing filtration is impaired somewhat by increasing salt concentration.

Ghatti gum was very difficult to disperse in mud, but after prolonged agitation muds were prepared that had very satisfactory filtration properties. The effect of ghatti gum on filtration and viscosity of a 20 per cent suspension of Finlay clay in saturated salt solution is shown in Fig. 3. Water loss is decreased from 70 to 5 c.c. in 30 min. by the use of 0.5 per cent ghatti gum. Increasing the concentration to 1 per cent brings about a further decrease to 2.5 c.c. Viscosity of the mud does not increase continually but tends to become constant between concentrations of 0.5 and 1 per cent of gum.

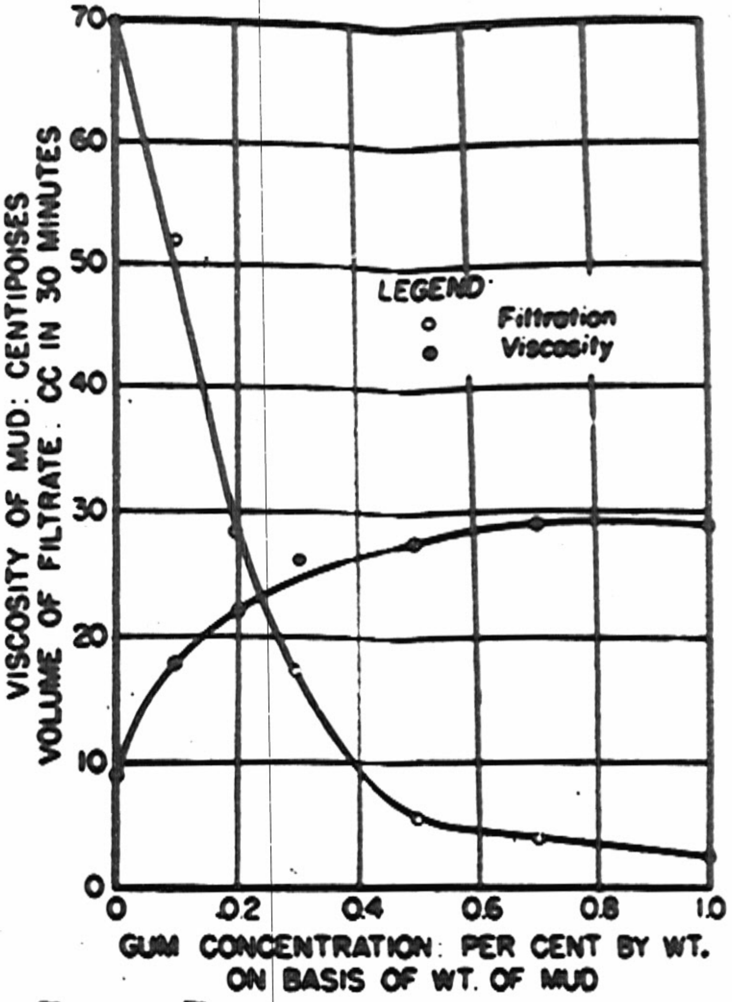
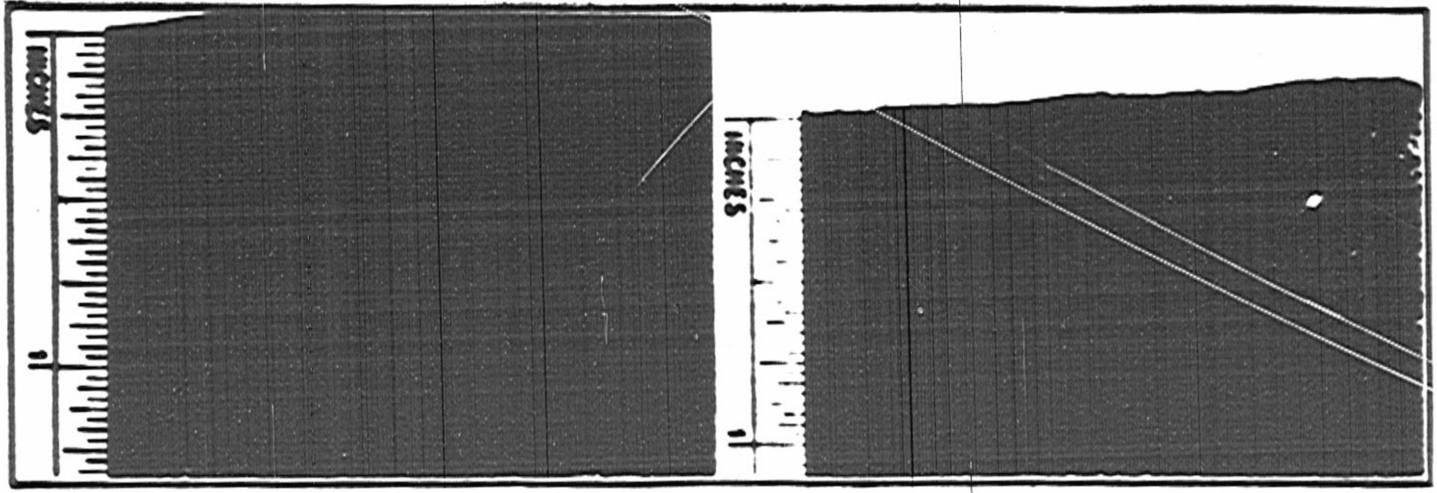


FIG. 3.—EFFECT OF GHATTI GUM ON FILTRATION AND VISCOSITY OF 20 PER CENT FINLAY CLAY IN SATURATED SALT SOLUTION.

To eliminate the possibility that the gum might be acting as sizing for the filter paper used in the wall-building tests, sand passing 100 mesh was employed as the filter medium. After the air in the pores had been displaced with salt solution, the permeability of the sand bed was found to be 2.5 darcys. Filtrations were carried out in duplicate, using 20 per cent suspensions of Shafter Lake clay in salt solution, with and without the addition of 0.5 per cent tragacanth gum. Filtration was continued for 60 min. at 100 lb. per sq. in. Filtrate volumes were 120 c.c. for the untreated sample and 20 c.c. for the sample containing gum. The thicknesses of the filter cakes formed are shown in Fig. 4. The superior wall-building qualities of the treated mud are obvious.

If gum is added to the mud, the clay concentration can be varied over fairly wide limits (10 to 20 per cent) without materially altering the filtration rate. Although the mechanism involved in reduction of filtration by gums has not been investigated in detail, it does not appear to be simply a matter of increasing the viscosity of the liquid phase, because the effect does not disappear when filtration is conducted at elevated temperatures.



a. Untreated Mud. *b*. Mud Containing 0.5 Per Cent Tragacanth Gum.

FIG. 4.—INFLUENCE OF TRAGACANTH GUM ON THICKNESS OF FILTER CAKE: 20 PER CENT SHAFTER LAKE CLAY IN SALT SOLUTION FILTERED ON SAND.

Addition of Irish Moss

Irish moss, whose behavior in salt-water muds is represented in Fig. 5, is a kelp that occurs along the coasts of Ireland and New England. The viscosity and filtration effects of this material are analogous to those of the gums. However, a greater quantity is required to produce the same effect, since the active ingredient is not separated from the rest of the plant and inert material is included in the addition. A mud consisting of 20 per cent of Finlay clay in salt water of the composition given previously exhibited a water loss of 59 c.c. in 30 min. The addition of 0.5 per cent of Irish moss reduced filtration to 15 c.c. and when 1 per cent was added the value was decreased to 11 c.c. in 30 minutes.

Addition of Gelatinized Starch

Another useful method for the control of the filtration characteristics of salt-water muds was found in the addition of gelatinized starch. Starch is the principal constituent of many plants, often concentrated in the seeds, tubers, or roots. Microscopic examination reveals the starch structure as individual granules of characteristic appearance. The major portion of the starch, called amylose, is stored within a membrane designated as amylopectin. Starches from various sources have similar chemical composition but may be identified by the characteristic appearance of the granule. Most starches on hydrolysis yield as fundamental units the sugar glucose and a small quantity of acidic material derived from the cell membrane. All such glucosans, regardless of such diverse sources as seeds of rice, wheat, and corn; tubers of potato and yam; roots of cassava and arrowroot; and pith of sago palm, have been found identical in their filtration-reducing properties.

To be effective the starch must be gelatinized or pasted. The addition of dry starch or a dispersion of starch in cold water, whether untreated or the so-called soluble starch, is equivalent to the addition of a like amount of inert material. Gelatinization consists in the rupture of the amylopectin cell membrane and swelling of the cell contents. This change in structure is revealed in Fig. 6. Among the various agents that accomplish the pasting of starch, the most potent is caustic soda. The relative amounts of starch and caustic soda

may be varied between rather wide limits. and the composition selected is determined by consideration of the convenience of handling the pasted mixture. A practical suspension for addition to drilling mud contains 10 per cent by weight of starch and 1 per cent of caustic soda.

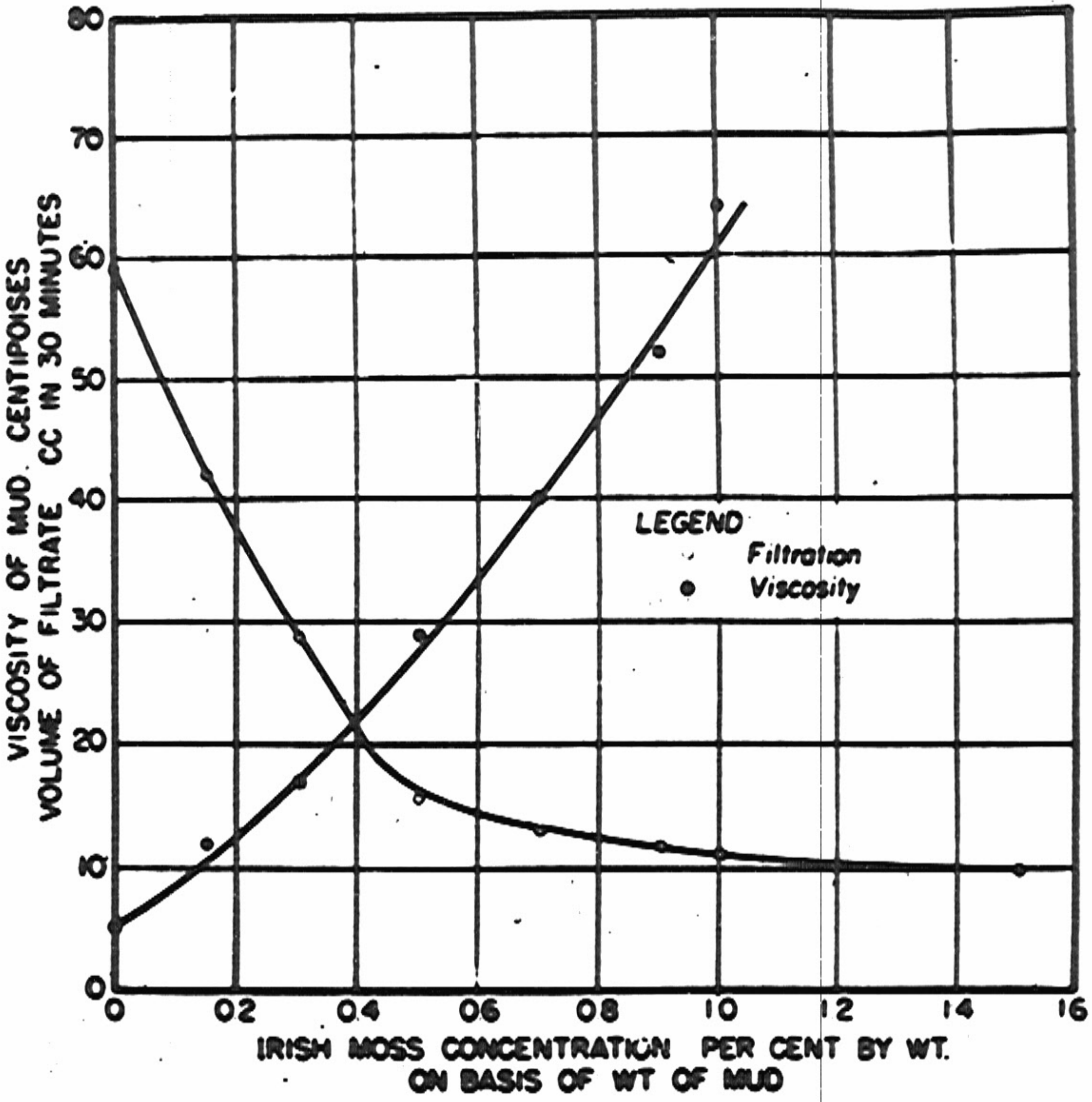


FIG. 5.—EFFECT OF IRISH MOSS ON FILTRATION AND VISCOSITY OF 20 PER CENT FINLAY CLAY IN SALT SOLUTION.

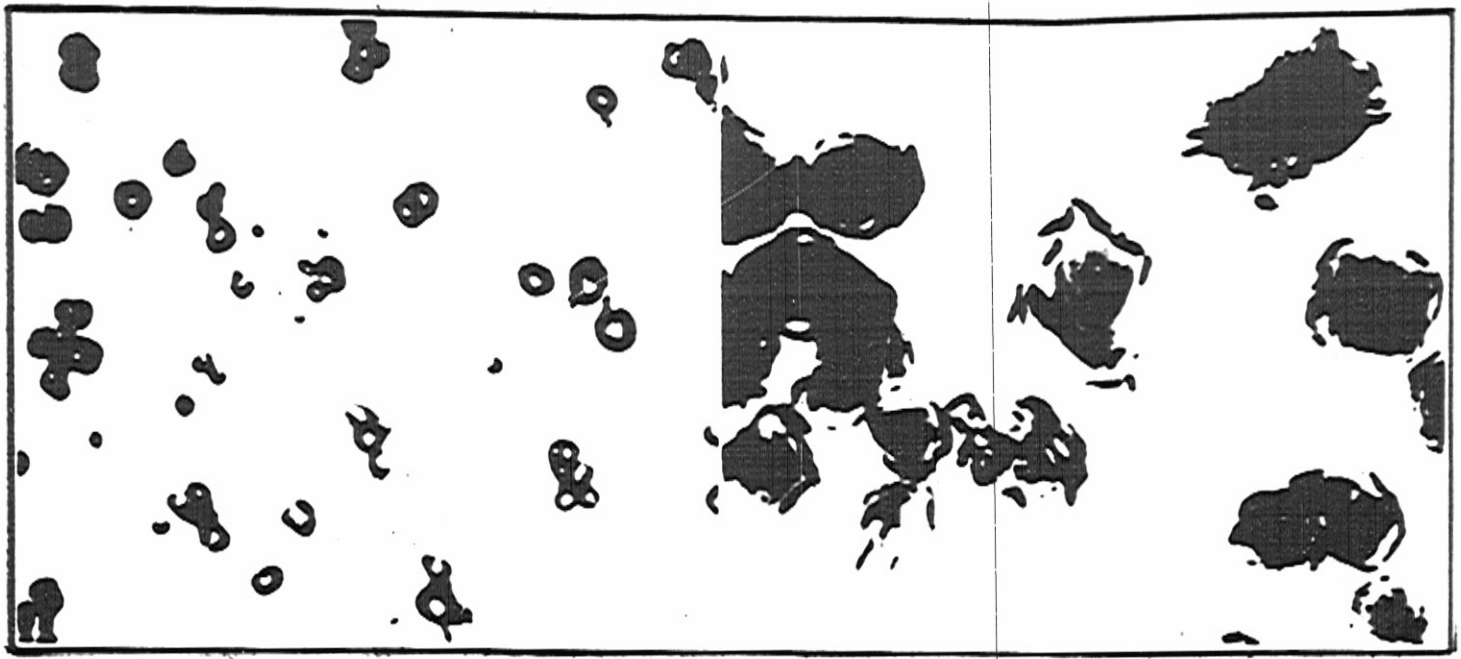
Fig. 7 presents the results of adding such a starch suspension to Finlay clay mud prepared with saturated salt solution. Starch concentration is expressed as percentage by weight of dry starch added. The addition of 1 per cent of gelatinized starch reduced the filtration of this mud from a value of 70 c.c. in 30 min. to about 5 c.c. Slightly lower values may be obtained by addition of greater quantities of starch, but water loss of about 5 c.c. may be considered a minimum for salt-water muds containing gelatinized starch. The increase in filtration observed upon the addition of small quantities of starch is characteristic for different clays, varying in magnitude from a negligible amount to an occasional quite high value. Small variations in starch concentration in the range 0.2 to 0.5 per cent produce marked changes in wall-building properties of salt-water muds.

Addition of gelatinized starch often results in erratic variations in the viscosity of salt-water muds. Usually, however, viscosity varies with starch concentration in a manner similar to that shown in Fig. 7. The viscosity increases to a maximum value, then falls off to about that of the original mud, and finally shows a slight increase. In general, salt-water muds treated with gelatinized starch show considerably lower viscosities than similar muds treated with the materials discussed earlier.

USE OF GUM IN FIELD TESTS

A West Texas field that offered drilling-mud problems typical of the area was selected for a field test. In this field, about

900 ft. of salt and salt-bearing rock must be drilled before the porous limestone section from which production is obtained is reached. It was common practice, when the limestone was reached, to discard the mud used in drilling the salt section and to complete the hole with mud made from commercial clays. A bentonite slurry was spotted in the bottom of the hole before casing was run.



a. Original Granules. × 200. *b.* After Pasting. × 200.

FIG. 6.—GELATINIZATION OF CORNSTARCH.

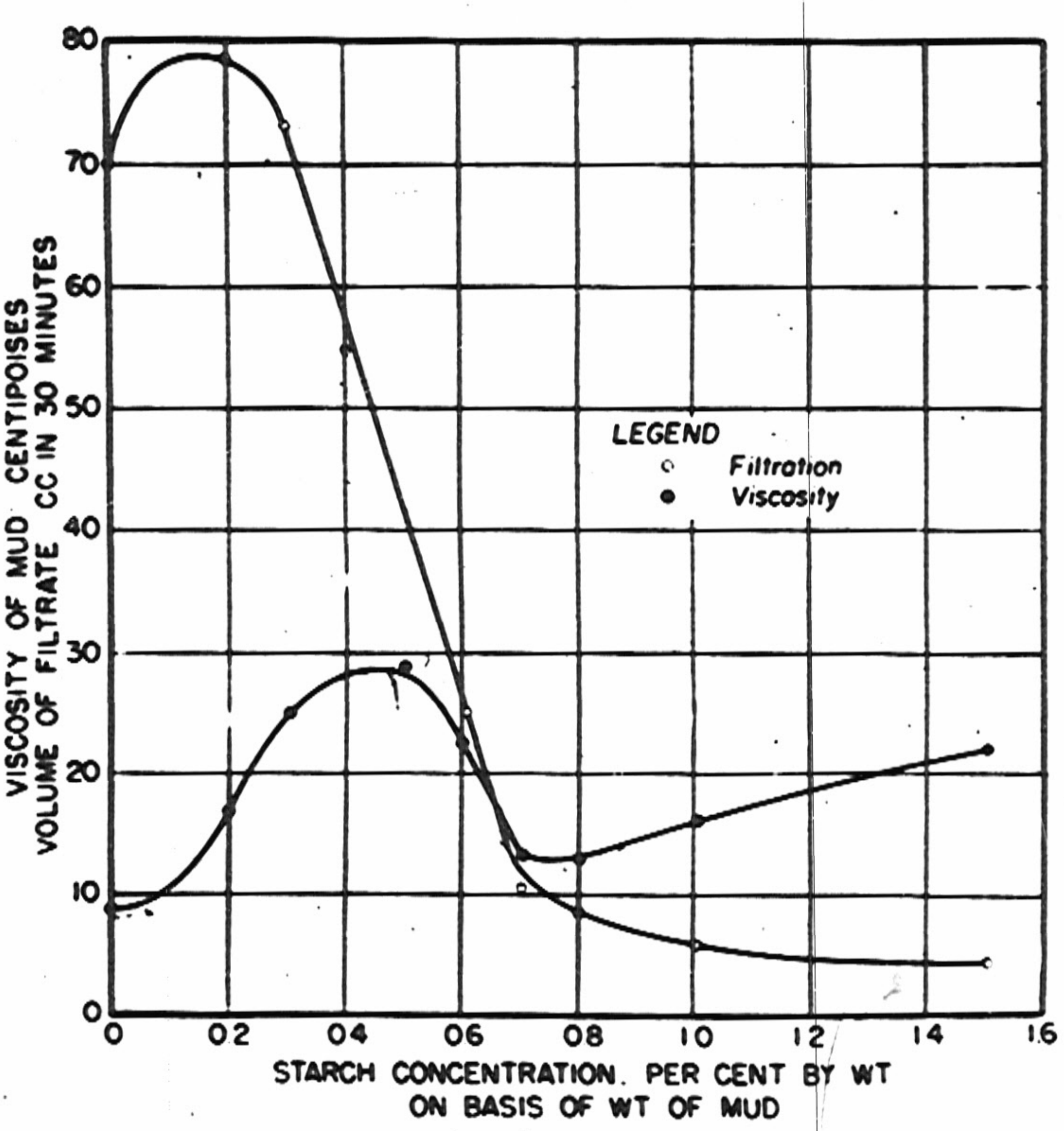


FIG. 7.—EFFECT OF GELATINIZED STARCH (10:1) ON FILTRATION AND VISCOSITY OF 20 PER CENT FINLAY CLAY IN SATURATED SALT SOLUTION.

Of the gums available, tragacanth seemed most satisfactory from the standpoint of effect on filtration and viscosity. In the first test, 1000 lb. of powdered tragacanth gum

was added to the mud used in drilling the salt and limestone sections. The average filtration was 70 c.c. in 30 min. On a second well, the mud was treated with 4000 lb. of tragacanth gum, and average water loss during the period of treatment was 26 c.c. in 30 min. In order to compare the treated and untreated muds, supervision was maintained simultaneously on a third well in which properties of the mud were controlled only by the addition of commercial clays. The average filtration value was 95 c.c. in 30 min. for the mud used in drilling the limestone section and 110 c.c. for that used in the salt section.

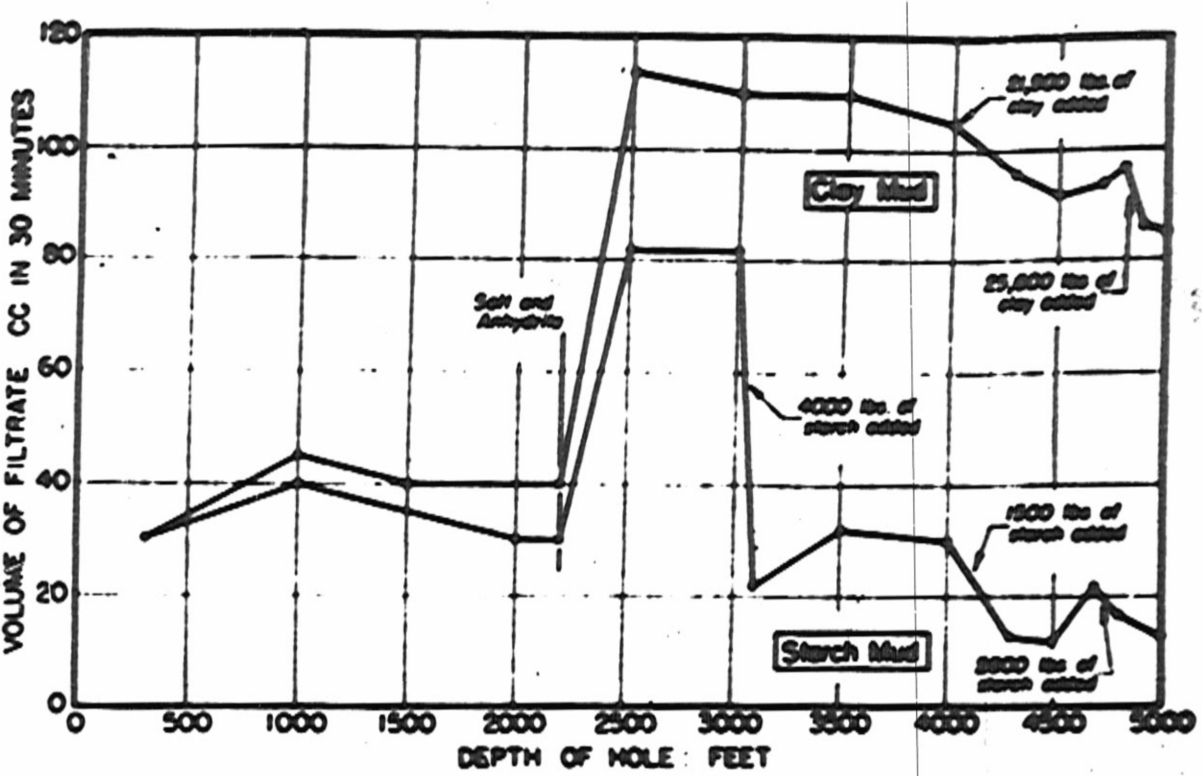


FIG. 8. COMPARISON OF FILTRATION RATES OF MUDS CONDITIONED WITH COMMERCIAL CLAY AND WITH GELATINIZED STARCH.

Water loss from the muds containing gum was significantly lower than from the untreated mud. The improved wall-building properties of the treated muds were shown even more definitely, although not in a way subject to numerical evaluation, by the condition of the holes. The hole drilled with clay mud alone was always tight, and it was necessary to wash out several feet of accumulated cavings and mud cake after each round trip to change bits. In contrast, no difficulty was experienced in getting back to the bottoms of the holes in which gum was used. After a twistoff in the first test well, the pipe was found to be free in the hole, whereas in other fishing jobs in this field the pipe was stuck. Bentonite slurry was not spotted on the bottom of the hole before running casing in the well on which 4000 lb. of gum was used and casing was landed and cemented without difficulty.

With the outbreak of hostilities abroad, further use of gums became impractical because of uncertainty in price and difficulty in securing delivery.

USE OF STARCH IN FIELD TESTS

The first field trial of gelatinized starch was made on a well in the same area as that of the gum tests. In preparing the pasted starch for field use, a box fitted with perforated steam coils was employed. Starch was intimately mixed with water by adding the starch through a mud-mixing hopper. Caustic soda was added, and the white, pasty mass was agitated with steam until a viscous, straw-colored suspension resulted. The final composition of the mixture was approximately 89 per cent water, 10 per cent cornstarch and 1 per cent caustic soda. The mud in the pit was stirred vigorously with the guns while the starch suspension was added.

Fig. 8 gives a comparison of the first field trial using starch and an adjacent well in which only commercial clays were used in mud control. The addition of starch was not begun until several hundred feet of salt had been penetrated. Water loss had increased from 30 to 82 c.c. in 30 min. Following the addition of 4000 lb. of starch, filtration was reduced to 22 c.c. in 30 min. Subsequent additions maintained an average water loss of 15 c.c. in 30 min. during the completion of the hole. No trouble was encountered in setting casing. The commercial clay mud showed an average water loss of 92 c.c. in 30 min. Throughout the limestone section, drilling progress was plagued by tight hole.

TABLE 1.—*Properties of Mud Samples from West Texas Wells*

Well No.	Density, Lb. per Gal.	Viscosity: Cp. Stormer at 600 R.p.m.	Filtration, C.C. in 30 Min.	Analysis of Filtrate, Parts per Million		
				Calcium	Chloride	Sulphate
1	11.1	10	71	1,920	133,500	5,295
2	11.6	15	60	1,830	130,000	7,200
3	11.9	27	85	1,700	154,000	4,733
4	11.2	8	220	2,775	136,500	3,550
5	10.3	5	370	2,380	74,000	4,375
6	10.5	17	330	2,420	50,000	4,320

So successful was the use of gelatinized starch in this and succeeding tests that the addition of starch to the mud prior to penetrating the limestone section became standard procedure in this area. The extension in use of starch was accompanied by a decrease in cost of drilling mud. Thus, on the test just described, mud cost was 13½¢ per foot from the surface to 5000 ft., as compared with a cost of 12¢ per foot for the clay mud in the neighboring well. The average mud cost in 50 wells subsequently drilled with mud containing pasted starch was 8.3¢ per foot from the surface, as compared with an average cost of 8.7¢ per foot for 17 wells previously drilled using commercial clay muds. Average properties and costs of these muds are summarized in Table 2. The lower cost of the starch-treated mud is due in no small measure to the increased attention given by the drilling crews to mud control in consequence of the close supervision demanded in the use of starch.

CONCLUSIONS

Laboratory tests indicated, and field use demonstrated conclusively, that filtration characteristics of salt-water muds can be improved markedly by the addition of natural gums or gelatinized starch. Additional evidence of improvement in wall-building properties was afforded by freedom from stuck drill pipe and ease of running casing to bottom in holes drilled with treated muds.

The extensive use of gums has not been undertaken because both supply and cost have been uncertain since the beginning of

TABLE 2.—*Comparison of Properties and Costs of Muds Conditioned with Commercial Clays and with Gelatinized Starch*

	Commercial Clay Muds	Gelatinized Starch Muds
Number of wells considered	17	50
Section drilled, feet per well	4,800	4,800
Productive section, feet per well	400	400
Filtration, cc. in 30 min.	91	15
Density, lb. per gal.	11.0	10.9
Viscosity, Marsh funnel	38	36
Starch used, lb. per well	0	4,000
Clay used, lb. per well	40,000	28,000
Cost of clay per well	$415	$225
Cost of drilling mud per foot of hole	8.7¢	8.3¢

war abroad. Starch, on the other hand, is readily available from a number of domestic sources. Pasted starch has been added to the mud used in drilling the productive section in about 80 wells in West Texas.

Although this study was directed particularly toward a solution of drilling-mud problems in West Texas fields, the results are applicable to other areas in which the mud becomes contaminated with salt. In the Gulf Coast, for example, overhanging, mushroom-type salt domes occur occasionally, and in marine operations it is frequently necessary to use sea water in making mud. In such conditions, wall-building properties of the drilling mud can be improved by the addition of gums or gelatinized starch.

References

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5. P. H. Jones and E. C. Babson: Evaluation of Rotary-drilling Muds. Drill. and Prod. Practice, Amer. Petr. Inst. (1935) 22.
6. D. H. Larsen: Loss of Water to Oil-Bearing Formations as a Basic Cause of Low Production. *Drilling Mud* (April 1937).
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8. D. H. Larsen: Determining the Filtration Characteristics of Drilling Muds. *Petr. Eng.* (Sept 1938) 42; (Nov. 1938) 50.
9. M. Williams and G. E. Cannon: Evaluation of Filtration Properties of Drilling Mud. Drill. and Prod. Practice, Amer. Petr. Inst. (1938) 20.
10. H. T. Byck: Effect of Temperature on Plastering Properties and Viscosity of Rotary Drilling Muds. *Trans.* A.I.M.E. (1940) 136, 165.
11. M. Williams: Radial Filtration of Drilling Muds. *Trans.* A.I.M.E. (1940) 136, 57.

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PLAINTIFF'S EXHIBIT 8.

Harth Patent No. 1,991,637,
Feb. 19, 1935.

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PLAINTIFF'S EXHIBIT 10.

Marsden Patent No. 376,445,
Jan. 17, 1888.

Pages 183-186

PLAINTIFF'S EXHIBIT 11.

Lawton et al., Patent No. 1,999,766,
Apr. 30, 1935.

PLAINTIFF'S EXHIBIT 12.

Impermex—Tons Sold.

Year	Pacific Coast	Mid-Continent	Gulf Coast	Export	Total
1941	....	404	42	....	446
1942	....	626	51	....	677
1943	....	1,831	154	....	1,985
1944	....	3,914	729	....	4,643
1945	512	4,724	1,507	91	6,834
1946	1,211	3,802	1,377	91	6,481
1947	1,678	4,500	2,104	584	8,866
1948	1,697	7,346	4,397	878	14,318
1949	624	5,187	3,274	311	9,396
Totals	5,722	32,334	13,635	1,955	53,646

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PLAINTIFF'S EXHIBIT 14.

Chapman Patent No. 2,399,986,
May 7, 1946.

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DEFENDANT'S EXHIBIT A.

Cannon Patent No. 2,109,858,
Mar. 1, 1938.

DEFENDANT'S EXHIBIT B

USEFUL TABLES

*pH RANGES OF COMMON INDICATORS

Name	pH Range	Color Change
Acid Cresol Red	0.2- 1.8	Red-Yellow
Acid. Meta Cresol Purple	1.2- 2.8	Red-Yellow
Thymol Blue	1.2- 2.8	Red-Yellow
Benzo Yellow	2.4- 4.0	Red-Yellow
Bromcresol Green	3.8- 5.4	Yellow-Blue
Bromphenol Blue	3.0- 4.6	Yellow-Blue
Methyl Red	4.4- 6.0	Red-Yellow
Chlorphenol Red	5.2- 6.8	Yellow-Red
Bromcresol Purple	5.2- 6.8	Yellow-Purple
Bromthymol Blue	6.0- 7.6	Yellow-Blue
Phenol Red	6.8- 8.4	Yellow-Red
Cresol Red	7.2- 8.8	Yellow-Red
Meta Cresol Purple	7.6- 9.2	Yellow-Purple
Thymol Blue	8.0- 9.6	Yellow-Blue
Phthalein Red	8.6-10.2	Yellow-Red
Tolyl Red	10.0-11.6	Red-Yellow
Parazo Orange	11.0-12.6	Yellow-Orange
Acyl Blue	12.0-13.6	Red-Blue

*APPROXIMATE pH VALUES

The following tables give approximate pH values for a number of acids and bases. All values are rounded off to the nearest tenth and are based on measurements made at 25° C.

pH VALUES OF ACIDS

Hydrochloric, N	0.1	Citric, 0.1N	2.2
Hydrochloric, 0.1N	1.1	Formic, 0.1N	2.3
Hydrochloric, 0.01N	2.0	Lactic, 0.1N	2.4
Sulfuric, N	0.3	Acetic, N	2.4
Sulfuric, 0.1N	1.2	Acetic, 0.1N	2.9
Sulfuric, 0.01N	2.1	Acetic, 0.01N	3.4
Orthophosphoric, 0.1N	1.5	Benzoic, 0.1N	3.0
Sulfurous, 0.1N	1.5	Alum, 0.1N	3.2
Tartaric, 0.1N	2.2	Carbonic (saturated)	3.8
Oxalic, 0.1N	1.6	Hydrogen Sulfide, 0.1N	4.1
Malic, 0.1 N	2.2	Arsenious (saturated)	5.0
Boric, 0.1N	5.2	Hydrocyanic, 0.1N	5.1

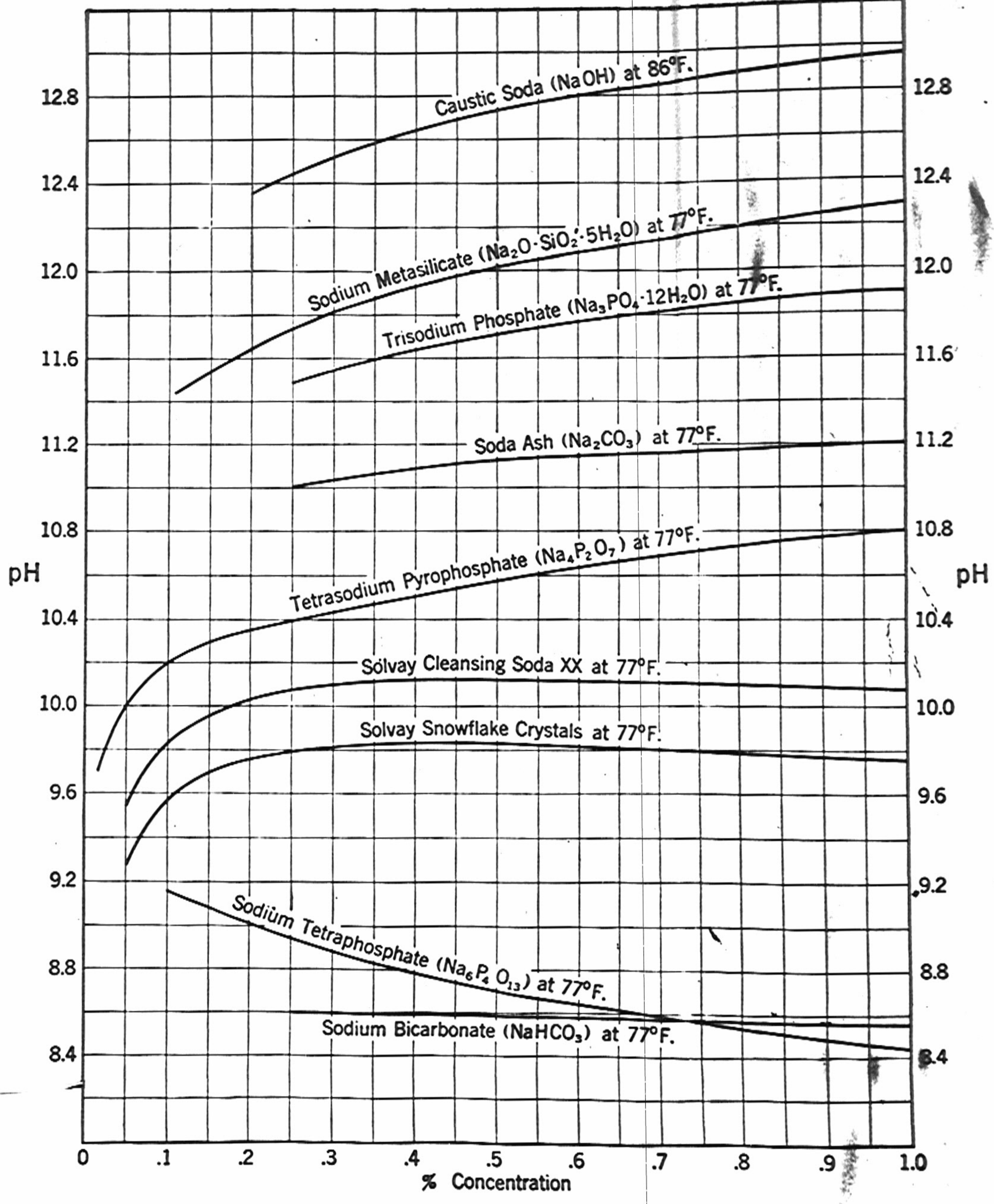
pH VALUES OF BASES

Sodium Hydroxide, N	14.0	Ammonia, N	11.6
Sodium Hydroxide, 0.1N	13.0	Ammonia, 0.1N	11.1
Sodium Hydroxide, 0.01N	12.0	Ammonia, 0.01N	10.6
Potassium Hydroxide, N	14.0	Potassium Cyanide, 0.1N	11.0
Potassium Hydroxide, 0.1N	13.0	Magnesia (saturated)	10.5
Potassium Hydroxide, 0.01N	12.0	Sodium Sesquicarbonate, 0.1N	10.1
Lime (saturated)	12.4	Ferrous Hydroxide (saturated)	9.5
Sodium Metasilicate, 0.1N	12.6	Calcium Carbonate, (saturated)	9.4
Trisodium Phosphate, 0.1N	12.0	Borax, 0.01N	9.2
Sodium Carbonate, 0.1N	11.6	Sodium Bicarbonate, 0.1N	8.4

* Reproduced from "Modern pH and Chlorine Control" by permission of W. A. Taylor and Co., Baltimore, Md.

DEFENDANT'S EXHIBIT C

pH VALUES OF SOLUTIONS OF SODA PRODUCTS



References: NaOH— Kiel & Loucks, Transactions Electro-Chemical Society, 67, 81 (1935).
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$Na_6P_4O_{13}$—Rumford Chemical Company—Industrial Bulletin No. 64.
$Na_2O. SiO_2. 5H_2O$—R. W. Harman, J. Phys. Chem., 30, 1100–11 (1926) & 29, 1155–68 (1925).
Others—C.D.R. 47.27—The Solvay Process Company Laboratories.

DEFENDANT'S EXHIBIT D.

Stern—Role of Clay and Other Minerals in Oil Well Drilling Fluids.

R. I. 3556.

The control of the thickness of the filter cake and its perviousness have a major importance in the control of the drilling operations and frequent routine tests on this property of the silicate mud are recommended. While it is claimed that it is possible to maintain conditions equal to those normally experienced with water muds, the filter test often shows erratic results. Occasionally it is possible to prepare salt-silicate muds which have the surprisingly low filter test of 5 cc. as measured according to the A. P. I. standard method for 30 minutes (3, 4). However the filter cake tends to be brittle and somewhat nonuniform in character; these conditions can be controlled but require careful supervision and add another hazard to the drilling difficulties.

The use of silicate has an objection incident to logging of the hole. A common practice in drilling is to obtain an electrical log of the formations by lowering a set of electrodes into the borehole and noting the electrical characteristics (resistivity and spontaneous potential) of the formation. These electrical determinations are predicated upon the usual condition that the drilling fluid is a relatively poor electrical conductor. The silicate-salt mud, however, contains a high concentration of electrolyte, and therefore is a good electrical conductor; the resulting short-circuiting through the hole slurs the formation character, hence it is extremely difficult to obtain an electrical log of a borehole of diagnostic or usable character when the silicate-salt fluid is used (although recent tests indicate that it is possible); for that reason, many operators hesitate to use it.

Alginate.—Sodium alginate, an extract of kelp, a seaweed abundant off the coast of California, has the characteristic of forming itno a fibrous, stringy, gelatinous mass when it reacts with a soluble calcium salt, such as calcium chloride. When wells are drilled, it frequently happens that a porous formation is penetrated, and then some way of sealing off the porosity is desired. To accomplish this the sodium alginate in water solution is pumped down the hole to the position where the sealing is to be accomplished. Then calcium chloride is pumped directly behind, and when the two react, calcium alginate is formed in the fibrous, stringy condition described above. The tough, fibrous matting occurs at the place where it is wanted, and claim is made[9] that it is effective even in porous formations where salt water occurs. Although the cost is appreciable the amount required may be small enough so that it can be used economically if it will accomplish its purpose.

Gum and Starch.—Several gums have been suggested and used as sources of colloidal material. They have been investigated because of the disturbing difficulty from the use of bentonite resulting in flocculation by salt water or other electrolyte. Gum tragacanth and several other organic gums have been tried, but the cost was prohibitive.

Starch has been mentioned as a mud addition agent in the patent literature, notably by Harth (60) and Cannon (21). Harth mentioned it as an alternative for bentonite, while Cannon describes its use with high concentration of alkali for drilling through heaving shale.

Starch is inferior to bentonite in those muds in which bentonite is effective, namely, fresh-water mud. Neither starch nor bentonite is effective to prevent filtration in a salt-water mud.

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[9] Red Seal Chemical Co., Los Angeles, Calif.

It is only recently that starch has found application in drilling muds as a result of the development that hydrolyzed starch imparts a good filter test to salt-water mud. For this purpose the starch may be hydrolyzed by boiling a 10-percent starch suspension in sodium hydroxide (1 percent by weight; or starch: sodium hydroxide 10:1). A pH of about 11 or 12 has been found desirable.

One important point is that starch tends to ferment unless a preservative is added. An effective preservative is sodium chloride (salt), so that it is possible to accomplish a dual function when drilling through a salt formation. The salt does not flocculate the hydrolyzed colloidal starch suspension, so that the desirable qualities of the mud are not destroyed, and the salt that does enter the mud acts as a preservative to prevent the fermentation of starch. A salt concentration of about 10 percent is adequate. It is surprising that the hydrolyzed starch does not increase the viscosity of the mud (in fact, reduces it slightly) and that the main effect is an improvement in the filter test, even when salt conditions are met. Barnes (7) also proposes the use of starch, with an alcohol, to attain the same objective. Certain clays are added to the mud to give it "body," even though the colloidal portion is replaced by the starch. This starch treatment is less expensive than the silicate drilling fluid and according to Cannon,[10] may be at least equally as effective.

Fibrous Materials.—Sugarcane bagasse, cottonseed hulls, straw, and even wood sawdust have been added to mud to improve its filter test, so that the mud will form a fibrous filter bed to span voids and porous portions of the formation. Recently shredded cellophane scrap has been used successfully, and flake mica (8) has been recommended for the same purpose. Whichever material is used, the purpose is the same—to bridge over the voids and form an impervious, thin, but tough sheath on the wall of the hole.

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[10] Cannon, George E., Humble Oil & Refining Co., Houston, Tex.

Control of Mud Properties—Chemical Treatment.

From the variety of materials used in the drilling muds, as described and discussed in the previous paragraphs, it would appear that the character of a mud can be controlled at will by suitable chemical treatment. That is quite true for almost any condition except one. No chemical treatment has yet been found that will prevent flocculation of clay suspensions when contaminated with salt water, although some benefit in resisting the * * *.

DEFENDANT'S EXHIBIT F.

Examiner's Statement.

Dated May 1, 1946.

This is the Examiner's Statement as to the appeal from the final rejection of claims 1 to 22, inclusive. The proposed amendment, filed September 10, 1945, which would cancel certain claims and amend others, has not been entered. (See paper No. 11.)

The claims* on appeal are as follows:

> 1. In the art of drilling wells by the employment of an aqueous drilling fluid, the process comprising, adding to such a fluid, a starchy colloid in an amount sufficient to substantially increase the viscosity and the wall-sealing properties of the fluid, while the fluid is maintained at a pH of about 12, in order to inhibit deterioration of the colloid.
>
> 2. In the art of drilling wells by the employment of an aqueous drilling fluid, the process comprising, bringing such a fluid to a pH of about 12 and thereafter adding a starchy colloid to said fluid in an amount

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* Note: These were later replaced by amended claims; see Examiner's letter, August 23, 1946, pages 212 to 214, infra.

sufficient to substantially increase the viscosity and the wall-sealing properties of the fluid.

3. In the art of drilling wells by the employment of an aqueous drilling fluid, the process comprising, adding to such a fluid, while maintained at a pH of about 12, sufficient of a starchy colloid to attain a substantial wall-seal of low water loss and at an operable well-drilling viscosity.

4. In the art of drilling wells by the employment of an aqueous drilling fluid, the process comprising, bringing such a fluid to a pH of about 12 and adding to such a fluid, sufficient of a starch colloid to attain a substantial wall-seal of low water loss and at an operable well-drilling viscosity.

5. In the art of drilling wells by the employment of an aqueous drilling fluid, the process comprising, bringing such a fluid to a pH of about 12, adding a starchy colloid to said fluid in an amount sufficient to substantially increase the viscosity and the wall-sealing properties of the fluid and thereafter maintaining said fluid at such pH.

6. In the art of drilling wells by the employment of an aqueous drilling fluid, the process comprising, adding to such a fluid, while maintained at a pH of about 12, a starchy colloid in an amount sufficient to attain a water-loss of less than 5 c. c.

7. In the art of drilling wells by the employment of an aqueous drilling fluid, the process comprising, bringing such a fluid to a pH of about 12 and adding a starchy colloid to said fluid in an amount sufficient to attain a water-loss of less than 5 c. c.

8. In the art of drilling wells by the employment of an aqueous drilling fluid, the process comprising, bringing such a fluid to a pH of about 12, adding a starchy colloid to said fluid in an amount sufficient to

attain a water loss of less than 5 c. c., and thereafter adding an alkali and a starchy colloid, when required, in amounts sufficient to maintain said pH and said water loss.

9. In the art of drilling wells by the employment of an aqueous drilling fluid the process comprising, adding to such a fluid, while maintained at a pH of about 12, from 3% to 6% of a starchy colloid as related to the weight of the fluid.

10. In the art of drilling wells by the employment of an aqueous drilling fluid the process comprising, bringing such a fluid to a pH of about 12 and thereafter adding a starchy colloid to said fluid in an amount from 3% to 6% as related to the weight of the fluid.

11. An aqueous well-drilling fluid of a pH of about 12 and containing sufficient of a starchy colloid to attain a substantial wall-seal of low water loss and at an operable well-drilling viscosity.

12. An aqueous well-drilling fluid of a pH of about 12 and containing a starchy colloid in an amount sufficient to have a water-loss of less than 5 c. c.

13. An aqueous well-drilling fluid of a pH of about 12 and containing a starchy colloid in an amount sufficient to have a water-loss of less than 3 c. c.

14. An aqueous well-drilling fluid of a pH of about 12 and containing from 3 to 6% of a starchy colloid as related to the weight of the fluid.

15. In the art of drilling wells by the employment of an aqueous drilling fluid, the process comprising, adding to such a fluid containing clay, a starchy colloid in an amount sufficient to substantially increase the viscosity and the wall-sealing properties of the fluid, while the fluid is maintained at a pH of about 12 in order to inhibit deterioration of said colloid.

16. In the art of drilling wells by the employment of an aqueous drilling fluid, the process comprising, adding to such a fluid a starchy colloid in an amount sufficient to substantially increase the viscosity and the wall-sealing properties of the fluid, while the fluid is maintained at a pH of about 12 in order to inhibit deterioration of said colloid and adding a concentrated colloidal clay to said fluid.

17. An aqueous clay-laden well-drilling fluid of a pH of about 12 and containing sufficient of a starchy colloid to attain a substantial wall-seal of low water loss and at an operable well-drilling viscosity.

18. An aqueous well-drilling fluid of a pH of about 12 and containing a concentrated colloidal clay and sufficient of a starchy colloid to attain a substantial wall-seal of low water loss and at an operable well-drilling viscosity.

19. An aqueous well-drilling fluid of a pH of about 12 and containing a concentrated colloidal clay and a starchy colloid in an amount sufficient to have a water-loss of less than 5 c. c.

20. In the art of drilling wells by the employment of an aqueous drilling fluid, the process comprising, bringing such a fluid to a pH of about 12 and adding a starchy colloid and a concentrated colloidal clay to said fluid in an amount sufficient to substantially increase the viscosity and the wall-sealing properties of the fluid.

21. In the art of drilling wells by the employment of an aqueous drilling fluid, the process comprising, adding to a cement-contaminated drilling fluid, a starchy colloid in an amount sufficient to substantially increase the viscosity and the wall-sealing properties of the fluid, while the fluid is maintained at a pH of about 12.

22. In the art of drilling wells by the employment of an aqueous drilling fluid, the process comprising, bringing a cement-contaminated drilling fluid to a pH of about 12 and thereafter adding a starchy colloid to said fluid in an amount sufficient to substantially increase the viscosity and the wall-sealing properties of the fluid.

The references relied on are:

Cannon 2,109,858, Mar. 1, 1938.

Stern—Role of Clay and Other Minerals in Oil-Well Drilling Fluids—Report of Investigations No. 3556 of Bureau of Mines—Feb. 1941—pages 76 and 77.

Chemicals by Glyco—page 121—pub. 1944 by Glyco Products Co., Inc., of Brooklyn.

The Solvay Blue Book—page 50—pub. 1943 by Solvay Sales Corp. of N. Y.

Subject Matter.

This case relates to aqueous drilling muds used in drilling oil and gas wells. The usual drilling mud is an aqueous suspension of clay used to remove cuttings, lubricate and cool the drill bit and plaster the walls of the borehole. When drilling where solid salt strata are encountered or where the drilling mud otherwise becomes heavily contaminated with soluble salts, it has been found advisable to add gelatinized starch to the mud, because the soluble salts tend to flocculate the colloidal material in the clay. However, it may be desirable to use gelatinized starch in drilling muds even where no soluble salts are present. The starch tends to ferment especially where there is not a high enough concentration of salts to prevent bacterial action. Applicants have found that fermentation can be prevented and a drilling mud made and maintained in an advantageous condition by rendering the mud highly alkaline and keeping it in that state when starch is used. The resulting mud, which may or may not contain clay in addition to the starch and alkali, has a very low water loss, a suitable viscosity for drilling, and is immune from deterioration due to fermentation. The water loss refers to the wall-sealing properties of the mud, that is, its ability to plaster the walls of the borehole so as to prevent any large amount of water from the mud from passing out into the formations being drilled. Low water loss is a very desirable property of a drilling mud. The viscosity should be low enough to allow easy pumping of the mud and quick settling of cuttings after the mud leaves the well, but high enough to keep the cuttings suspended until the mud can carry them out of the well. Applicants use enough alkali to keep the pH of the mud at about 12 and enough starch to give a water loss of less than 5 c. c.'s preferably and to keep the viscosity between desirable operating limits.

The Rejections.

All the claims stand finally rejected as being unpatentable over the Cannon patent and over the Stern patent. The Examiner does not contend that these references teach the basic principle of applicants discovery, but they do show the use in drilling muds of the same materials and in the same proportions as these are set forth in the claims. It is immaterial that the materials are added for a different purpose, or that the patentee and the author did not appreciate all the advantages that resulted from the use of these compositions.

Cannon discusses the addition of "treating agents" to drilling muds to prevent disintegration of heaving shale. The "treating agents" are substances ordinarily used to reduce the viscosity of aqueous drilling muds. Cannon, however, uses them in amounts many times greater than those used for viscosity-reduction (page 1, column 2, lines 9 to 19). These treating agents comprise an alkaline material such as caustic soda and an organic compound containing three or more hydroxyl groups. Starch is listed as an example of such a compound (page 2, column 1, lines 2 to 5). The preferred material, according to Cannon, is tannin in the form of quebracho extract, and this is the material shown in the specific examples. In order to make up for the excessive thinning of the mud by these abnormally large amounts of "treating agents," correspondingly large amounts of bentonite, or other colloidal materials are added to the mud. Bentonite is a concentrated colloidal clay meeting the terms of claims 18, 19 and 20 in this respect. The amount of caustic soda used is such as to give a pH of about 12 to the mud. The Chemicals by Glyco citation and the graph in the Solvay Blue Book show that the percentages of alkali shown in the examples in the Cannon patent would give a pH of about 12. This is a chemical fact and applicants have admitted it. There has been disagreement between the Examiner and the applicants as to the amount of starch to be used according to the teaching of the Cannon patent. The Examiner contends that the amount is that equivalent to the amount of quebracho extract in the specific examples, which amount is 2%. The equivalent amount would also be about 2%. Applicants contend that the quebracho and starch are both used to reduce the viscosity, that the amount of starch that Cannon would use would be that which would give a viscosity reduction, and that this amount is much less than 2%. In the Examiner's opinion this argument is fallacious because the premise on which it is based is incorrect. Cannon does not use the starch or quebracho to reduce the viscosity. He states that he uses these materials, which ordinarily reduce the viscosity, in amounts "at least fifty to one hundred times as high" as would be ordinarily used to reduce the viscosity (page 1, column 2, lines 9 to 13). Therefore, in following the teaching of the Cannon patent, you would use the same amounts that applicants suggest using and these amounts would be within the range in the present claims.

The Stern publication discloses the use of gelatinized (hydrolyzed) starch and sodium hydroxide in high concentrations in a salt water drilling mud. The pertinent portion is:

> "It is only recently that starch has found application in drilling muds as a result of the development that hydrolyzed starch imparts a good filter test to salt-water mud. For this purpose the starch may be hydrolyzed by boiling a 10 percent starch suspension in sodium hydroxide (1 percent by weight; or starch: sodium hydroxide 10:1). A pH of about 11 or 12 has been found desirable."

Applicants do not dispute the fact that a 1% sodium hydroxide solution would have a pH of about 12. From the graph on page 50 of the Solvay Blue Book it appears that a 1% caustic soda solution would have a pH of about 12.95 at 86° F. Applicants contend that the statement "a pH of about 11 or 12 has been found desirable" means that the pH of the **starch-caustic soda** mixture should be 11 or 12 and not that the pH of the **mud** to which it is added must be 11 or 12. The Examiner is convinced that it is the pH of the mud that is referred to. When you specify the amounts of sodium hydroxide, water and starch, the pH is fixed. A 1% solution of sodium hydroxide (caustic soda) must necessarily have a pH of about 12.95. The presence of the starch will not materially change the pH. Therefore the only composition whose pH could vary is the finished mud, and this is what Stern must be referring to when he states that a pH of 11 or 12 has been found desirable. If a condition is stated as being desirable, this presupposes a choice, a possibility that conditions may be varied. Since the starch-caustic soda mixture cannot vary in pH, Stern must have meant that the drilling mud could be adjusted to the most desirable pH of 11 or 12.

Conclusion.

It is believed that the final rejection of all the claims as being unpatentable over the prior art is sound and proper. It is respectfully requested that this rejection be sustained.

Examiner.

EXAMINER'S LETTER, AUGUST 23, 1946.

Responsive to amendment filed July 29, 1946.

The proposed amendments, filed September 10, 1945, June 21, 1946, and July 29, 1946, (papers No. 8, 14, and 16) have now been entered since they appear to place the case in better condition for appeal. These amendments do not put the case in condition for allowance. The grounds of rejection made in the Office actions of August 22, 1944 and May 22, 1945, and discussed in the Examiner's Statement on Appeal are still considered sound. The case is therefore being returned to the jurisdiction of the Board of Appeals. The claims now on appeal are 3, 4, 5, 8, 11, 15 to 18, 21, and 22. In their amended form they are reproduced below:*

> Claim 3. In the art of drilling wells by the employment of an aqueous mud-laden drilling fluid, the process comprising, adding to such a fluid, while maintained at a pH of about 12, sufficient of a starchy colloid to attain and maintain a substantial wall-seal of low water loss, viz., below 5 c. c. (A. P. I.) and at an operable well-drilling viscosity.
>
> Claim 4. In the art of drilling wells by the employment of an aqueous mud-laden drilling fluid, the process comprising, bringing such a fluid to a pH of about 12 and adding to such a fluid while maintained at such pH, sufficient of a starchy colloid to attain

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* Note: Claims 11, 17 and 18 were later withdrawn.

and maintain a substantial wall-seal of low water loss, viz., below 5 c. c. and at an operable well-drilling viscosity.

Claim 5. In the art of drilling wells by the employment of an aqueous mud-laden drilling fluid, the process comprising, bringing such a fluid to a pH of about 12, adding a starchy colloid to attain a substantial wall-seal of low water-loss, viz., below 5 c. c. (A. P. I.) and at an operable well-drilling viscosity, and thereafter maintaining said fluid at such pH in order to maintain such water-loss.

Claim 8. In the art of drilling wells by the employment of an aqueous mud-laden drilling fluid, the process comprising, bringing such a fluid to a pH of about 12, adding a starchy colloid to said fluid in an amount sufficient to attain a substantial wall-seal of low water-loss, viz., below 5 c. c. (A. P. I.) and at an operable well-drilling viscosity, and thereafter adding an alkali and a starchy colloid, when required, in amounts sufficient to maintain said pH and said water loss.

Claim 11. An aqueous mud-laden well-drilling fluid maintained at a pH of about 12 and containing sufficient of a starchy colloid to attain and maintain a substantial well-seal of low water loss, viz., below 5 c. c. and at an operable well-drilling viscosity.

Claim 15. In the art of drilling wells by the employment of an aqueous mud-laden drilling fluid, the process comprising, adding to such a fluid containing a colloidal clay, a starchy colloid in an amount sufficient to attain and maintain a substantial wall-seal of low water-loss, viz., below 5 c. c., while the fluid is maintained at a pH of about 12.

Claim 16. In the art of drilling wells by the employment of an aqueous mud-laden drilling fluid, the process comprising, adding to such a fluid a starchy colloid in an amount sufficient to attain and maintain a substantial wall-seal of low water-loss, viz., below 5 c. c., while the fluid is maintained at a pH of about 12 and adding a concentrated colloidal clay to said fluid.

Claim 17. An aqueous clay-laden well-drilling fluid maintained at a pH of about 12 and containing sufficient of a starchy colloid to attain and maintain a substantial wall-seal of low water loss, viz., below 5 c. c. and at an operable well-drilling viscosity.

Claim 18. An aqueous mud-laden well-drilling fluid maintained at a pH of about 12 and containing a concentrated colloidal clay and sufficient of a starchy colloid to attain and maintain a substantial wall-seal of low water loss, viz., below 5 c. c. and at an operable well-drilling viscosity.

Claim 21. In the art of drilling wells by the employment of an aqueous mud-laden drilling fluid, the process comprising, adding to a cement-contaminated drilling fluid, a starchy colloid in an amount sufficient to attain and maintain a substantial wall-seal of low water-loss, viz., below 5 c. c., while the fluid is maintained at a pH of about 12.

Claim 22. In the art of drilling wells by the employment of an aqueous mud-laden drilling fluid, the process comprising, bringing a cement-contaminated drilling fluid to a pH of about 12 and thereafter adding a starchy colloid to said fluid in an amount sufficient to attain and maintain a substantial wall-seal of low water-loss, viz., below 5 c. c.

JRL:RR Examiner

DEFENDANT'S EXHIBIT H.

Decision of Board of Appeals.

Dated July 4, 1948.

This is an appeal from the action of the Examiner finally rejecting claims 3, 4, 5, 8, 11, 15, 16 to 18, inclusive, 21 and 22. These are all the claims which now remain entered in the case. Claims 11, 17 and 18 have been withdrawn and the appeal will be dismissed as to these claims.

Claim 3 will serve as illustrative and reads as follows:

> 3. In the art of drilling wells by the employment of an aqueous mud-laden drilling fluid, the process comprising, adding to such a fluid, while maintained at a pH of about 12, sufficient of a starchy colloid to attain and maintain a substantial wall-seal of low water loss, viz., below 5 c. c. (A. P. I.) and at an operable well-drilling viscosity.

The references relied upon are:

Cannon 2,109,858, Mar. 1, 1938.

Stern—Role of Clay and Other Minerals in Oil-Well Drilling Fluids—Report of Investigations No. 3556 of Bureau of Mines—Feb. 1941—pages 76 and 77.

Chemicals by Glyco—page 121—pub. 1944 by Glyco Products Co., Inc., of Brooklyn.

The Solvay Blue Book—page 50—pub. 1943 by Solvay Sales Corp. of N. Y.

This application relates to the art of drilling wells. The Examiner, in page 4 of his Statement of May 1, 1946, has gone into considerable detail concerning the peculiar problems in this art, which need not be repeated here. The appealed claims recite a process in the art of drilling wells by the employment of an aqueous mud-laden drilling fluid which comprises adding to such a fluid while maintained at a pH of about 12, sufficient of a starchy colloid to attain and maintain a substantial wall-seal of low water loss and at an operable well drilling viscosity. The water loss is below 5 c. c. according to the testing procedure set up by the American Petroleum Institute. Appellants' specification points out that it is old to use starch in mud-laden well drilling fluids but the starch deteriorates by fermentation. Appellants overcame this deterioration and fermentation by maintaining the fluid at a pH of about 12. This pH may vary from about 11.7 to 13.3 as shown by page 7 of the specification. Above pH 13.3, the starch tends to begin to become less effective.

The Examiner has cited a number of references. Cannon shows a well drilling fluid which is made and kept distinctly alkaline. Starch is mentioned as a constituent.

The Stern publication mentions the use of starch in well drilling muds and states that a pH of 11 or 12 is desirable.

Page 50 of the Solvay Blue Book shows that a 1% caustic soda solution has a pH of about 12.9.

Page 121 of Chemicals by Glyco shows the pH values of various bases and acids.

The claims have been rejected as being unpatentable over the Cannon patent or over the Stern publication. The Examiner appears to concede that these references do not add the alkali for the purpose of preventing fermentation and deterioration of the starch. However, he contends that the references show the addition to drilling muds of starch and alkali in substantially the same proportions as set forth in the claims and that it was immaterial that the agents are added for a different purpose or that the references did not appreciate all the advantages that resulted from the use of these compositions.

In the rejection on Cannon, the Examiner notes that this reference discusses the addition of "treating agents" to drilling muds to prevent disintegration of heaving shale, and that such agents are substances ordinarily used to reduce the viscosity of aqueous drilling muds. Cannon uses them in amounts many times greater than those used for viscosity reduction (page 1, Column 2, lines 9 to 13). These treating agents comprise an alkaline material such as caustic soda and an organic compound containing three or more hydroxyl groups. Starch is set forth as being an example of such a suitable organic compound in page 2, column 1, lines 2 to 5. The only specific examples in Cannon show Quebracho extract which is tannin or tannic acid. In order to make up for the excessive thinning of the mud by the large amounts of treating agents, large amounts of bentonite are added. The Examiner states that the amount of caustic soda is such as to give a pH of about 12 to the mud and he refers to the graph in the Solvay Blue Book and the Chemicals by Glyco to show that the percentage of alkali set forth in the examples in the Cannon patent would give a pH of about 12. The Examiner holds this to be a chemical fact and that applicants have admitted it, but he failed to point out just where this admission occurs in the record.

The Examiner contends that the amount of starch suggested to be used by Cannon would be the same as the 2% Quebracho extract as they have been disclosed as equivalents. Thus, the Examiner holds that Cannon shows the addition of starch and alkali to a well drilling mud in substantially the same proportions as employed by appellants.

In his rejection on the Stern publication, the Examiner quotes the second complete paragraph on page 77 showing the addition of starch to drilling muds and that a pH of 11 or 12 has been found desirable. The Examiner holds that this pH refers to the mud since the starch suspension has been prepared with 1% by weight of sodium hydroxide which would give a pH of 12.95 stating that the starch would not materially change the pH. Thus, the only composition whose pH could vary is the finished mud, and the Examiner concludes that this is what Stern must be referring to when he states that a pH of 11 or 12 has been found desirable. Since the starch-caustic soda mixture has a fixed higher pH value, the Examiner holds that Stern must have meant that the drilling mud could be adjusted to a pH of 11 or 12.

Appellants have argued in an extended and carefully detailed brief that the references do not disclose and do not teach their invention. They have discussed at length the problems in the well drilling art and two patents not cited by the Examiner as illustrating the prior art. They state that the invention is extremely important and has gone into wide use. Reference is made to an affidavit received September 10, 1945 by Professor Dodge who concludes that subject matter claimed is entirely new, has gone into wide use and has been highly successful. Appellants emphasize that the fluid is maintained at a pH of about 12 and that it is not sufficient that the drilling fluid be simply brought to this pH. Above pH 13.3, the starch tends to begin to become less effective.

Appellants contend that Cannon is for an entirely different process than their own, since he deals with the problem of heaving shale in well drilling. Cannon overtreats the drilling fluid with a high proportion of caustic and tannin to drastically reduce viscosity and then restores viscosity by adding bentonite. While appellants admit that Cannon shows starch, they maintain that he does not show how much to use and that there is no suggestion that the same amount of starch be used as Quebracho extract. In fact, appellants contend that it was a mistake for Cannon to include starch with tannins and that the starch should have been classified with bentonite and other colloidal material. It is argued that since some of the specific examples of

Cannon show 2% and 7% caustic soda, that a pH way beyond 12 would result and that at such a pH, starch would break down to sugar. No evidence was presented to support this argument that the starch would become sugar.

As for the Stern publication, it is contended that it is just as far fetched as Cannon as a reference. Gum and starch are commented upon under one heading by Stern. Bentonite also is discussed under this heading and appellants conclude that all these agents should be classified together. Stern comments on the inferiority of starch to bentonite in fresh water mud. The paragraph following this comment reads:

> "It is only recently that starch has found application in drilling muds as a result of the development that hydrolyzed starch imparts a good filter test to salt-water mud. For this purpose the starch may be hydrolyzed by boiling a 10-percent starch suspension in sodium hydroxide (1 percent by weight; or starch: sodium hydroxide 10.1). A pH of about 11 or 12 has been found desirable."

This paragraph according to appellants merely means nothing but a process of hydrolyzing starch and there is no teaching that Stern meant to maintain the drilling mud at pH 11 or 12.

We have given careful consideration to the complete discussion and arguments presented on behalf of appellants, but we are of the opinion that the conclusion reached by the Examiner is correct as to each of the references. Cannon cannot be dismissed because he was trying to solve a problem encountered with heaving shale. Cannon was doing what appellants are doing and that is drilling wells employing a well drilling fluid which is maintained alkaline with a concentration of caustic soda in excess of ⅓ of 1% by weight of the drilling mud. Thus, the pH value of the drilling mud as shown by the chart in the Solvay Blue

Book begins about pH 12.6. When 1% caustic soda is used, as shown in the specific example in page 2, column 2, lines 3 to 8 of Cannon, the pH will be about 12.95. There is no showing by appellants that a high pH is harmful. Actually, they show that at a pH of above 13.3, the starch only tends to begin to become less effective. Thus, there is nothing critical in the pH of about 12 recited in the claims and we believe that about this pH is fully shown by Cannon.

The only remaining feature in controversy in Cannon is the inclusion of starch as the equivalent of tannic acid or Quebracho extract. Appellants contend that this is a mistake. We do not so find it, since Cannon deliberately, and not accidentally, as far as we can determine, included starch as an equivalent of tannic acid as the organic compound capable of being used in the alkaline well drilling mud. He not only disclosed this, but also all the claims recite the starch and tannic acid as equivalents in the Markush group. It is true that no specific example of Cannon shows starch. In the three specific examples on page 2, second column, only Quebracho extract (crude tannic acid) is disclosed and 2% of it is used in the second and third examples. In view of the teaching of equivalency by Cannon of starch and tannic acid, we do not regard that the Examiner is in error in assuming that about the same amount of starch would be used as the tannic acid or Quebracho extract. In any event, Cannon points out in page 2, column 2, lines 10 to 15 that the proportions of Quebracho extract as well as other ingredients can be varied over a wide range. We are therefore of the opinion that Cannon is a proper anticipation of the recital in the claims of a starchy colloid in substantially the proportions recited. Cannon adds bentonite and it is noted that appellants also may add bentonite or other colloidal clay and that claims reciting this addition have been cancelled. Cannon does not show that the alkaline condition of the mud would prevent the starch content of the well drilling mud from deterioration or fermentation. We agree with the Examiner that it was immaterial whether or not Cannon knew this. There is no showing that even the higher concentrations of alkali included in Cannon would cause the starch content of the drilling mud to turn into sugar or that it would be materially detrimental to the process.

As for the Stern publication, there is no doubt that it shows the use of starch in well drilling muds for the very same purpose as employed by appellants, so as to impart a good filter test. For this purpose the starch is hydrolyzed in 1% sodium hydroxide which the Examiner points out will give a pH of about 12.9 to the mixture. If this is so, and there appears to be no convincing evidence to the contrary, the statement in Stern that a pH of 11 or 12 has been found desirable may properly be regarded as applying to the drilling mud containing the hydrolyzed starch. We therefore agree with the Examiner's interpretation of this reference and are of the opinion that it teaches a well drilling mud having a pH of about 11 or 12 and containing hydrolyzed starch. The maintenance of the mud at this pH we do not regard as a patentable distinction, if any. The claims do not, in our opinion, define anything patentable over the Stern publication. While Stern, like Cannon, does not disclose that the alkali keeps the starch in the well drilling mud from spoiling or fermenting, the discovery of this property of an old well drilling mud cannot impart patentability to the otherwise patentable well drilling mud. In this connection we direct attention to In re Jones, 1941 C. D. 686, 120 F. (2d) 1019, wherein the Court stated:

> "The only difference we can perceive between the disclosure of appellant and that of the reference is that appellant has discovered an additional result in the use of the same added materials with drilling mud. This, of itself, cannot lend patentability to the claims. See In re King et al., 27 C. C. P. A. (Patents) 754, 107

> F. (2d) 618; In re Newton et al., 25 C. C. P. A. (Patents) 1106, 96 F. (2d) 291; In re James, 23 C. C. P. A. (Patents) 1124, 83 F. (2d) 313, and In re Burk, 22 C. C. P. A. (Patents) 731, 73 F. (2d) 497."

The appeal is dismissed as to claims 11, 17 and 18.

The decision of the Examiner is affirmed.

In event of appeal attention is directed to In re Boyce, 32 C. C. P. A. 718, 144 Fed. (2d) 896, 1944 C. D. 609, 568 O. G. 568, 63 U. S. P. Q. 80, in regard to specifically including in the appeal notice all grounds of rejection in the Examiner's Statement not expressly overruled by the Board.

E. F. Klinge,)
Examiner-in-Chief.)
E. W. Geniesse,) Board
Examiner-in-Chief.) of
I. G. Stone,) Appeals
Examiner-in-Chief)
(Acting).)

June 4, 1948.

Messrs. Bruninga and Sutherland,
1004 Market Street,
St. Louis, Missouri.

No. 10,873.

APPELLANT'S BRIEF.

UNITED STATES COURT OF APPEALS

FOR THE DISTRICT OF COLUMBIA CIRCUIT.

NATIONAL LEAD COMPANY, a Corporation,
Appellant,
vs.
JOHN A. MARZALL, Commissioner of Patents,
Appellee.

Appeal from the United States District Court for the District of Columbia.

United States Court of Appe
For the
District of Columbia Circuit

FILED FEB 26 1951

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STATEMENT OF QUESTIONS PRESENTED.

The application in suit, for a process, is based on a discovery by the applicants that if a drilling fluid used in the drilling of oil and gas wells and containing gelatinized starch, is maintained at a specified high alkalinity, then the fluid will be rendered and maintained immune against fermentation; which otherwise would deteriorate the fluid. The invention is of great value to the art. The prior art relied on by the Patent Office does not disclose that discovery. All that is conceded by the Patent Office.

The Stern Report relied on specifies the alkalinity of a gelatinized suspension and not of the drilling fluid itself. The Cannon patent discloses the employment of caustic soda and tannic acid to reduce the viscosity of the drilling fluid. It simply mentions "starch", not gelatinized starch. Any attempt to substitute starch for tannic acid in the Cannon process will render it inoperable. All that was confirmed by four highly skilled in this art witnesses supported by authoritative literature; and their testimony was not refuted by defendant at the trial. The question is, do those citations constitute a statutory bar against the application?

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Appeal from the United States District Court for the District of Columbia.

JURISDICTIONAL STATEMENT.

This is a Civil action under R. S. 4915, 35 U. S. C. 63, by plaintiff-appellant, National Lead Company, Assignee of the Sikes and Beesley application, Serial No. 489,890, against defendant-appellee, John A. Marzall, Commissioner of Patents, for a judgment authorizing the Commissioner to issue a patent on that application to plaintiff. There are no adverse parties other than the Commissioner of Patents, because this action is from a Decision of the Board of Appeals affirming the Primary Examiner in his rejection of all of the claims remaining in the application, none having been allowed. The jurisdiction is set out in the Complaint, App. 1.*

After a trial on testimony, depositions and exhibits, the District Court rendered an "Informal Memorandum", App. 6, in favor of appellee refusing all of the claims in suit and approved Findings of Fact and Conclusions of Law as submitted by defendant-appellee, App. 6-8, and a Judgment dismissing the Complaint, App. 12. Plaintiff's Proposed Findings of Fact, App. 8-11, were not approved and Plaintiff's Motion for a New Trial, App. 12, was overruled, App. 22. This appeal is under 28 U. S. C. 1291.

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* There is a printed Joint Appendix, to which reference is had as App. The transcript before the District Court will be referred to as Tr. and the depositions as Dep.; both are noted in the margin of the Joint Appendix.

STATEMENT OF CASE.

The invention of the application in suit relates to the art or process of drilling wells, particularly oil and gas wells, by the almost universally used rotary system of drilling and which employs an aqueous mud-laden drilling fluid, also called a drilling mud. More specifically the drilling fluid is one in which a "starchy colloid", i. e., gelatinized starch is added to the drilling fluid to seal the wall of the bore-hole against passage or "loss" of water from the drilling fluid to the formation being drilled.

The characteristic feature of the invention resides in maintaining the alkalinity of the drilling fluid at a definite value, so as to not only attain, but to maintain the wall seal at a "low water loss", during the course of drilling, but with all at an operable viscosity or consistency. The specification and the claims, as will be later shown, express the alkalinity as well as the water loss in well known scientific terms, the former as "at a pH of about 12" and the latter as "below 5 cc".

The application in suit is unusual, because, it not only acknowledges what was in the prior art, but distinguishes therefrom as an art or process, as well as setting out the advantages thereover which are distinct.

The process has, since the year 1943, the year of the filing of the application, gone into rapidly increasing use, Pl. Ex. 12, App. 187, identified App. 39, Tr. 55. Indeed so important to the well drilling art was the process deemed by the War Production Board during the late war, that plaintiff was permitted and even encouraged to sell gelatinized starch, a food product, in trainloads to the well drilling industry, App. 40, Tr. 58. At the time of the trial at least one-half of gelatinized starch was used in accordance with applicant's process, the rest was used where the drilling is through salt, App. 38, Tr. 49, later discussed p. 7, infra.*

We want to observe here that the policy of plaintiff is not to monopolize for itself the exclusive use of the process or of gelatinized starch sold for such employment, but plaintiff offers licenses under its patents at a reasonable royalty without restriction as to purchase of materials from others than plaintiff, App. 94, Dep. 25.

In view of the above we deem it necessary to discuss the application in suit and the prior art acknowledged therein, somewhat more than would ordinarily be necessary, in order to show the **status or niche** which this invention occupies. We want to observe here that that status is substantiated by three witnesses highly skilled in this art, scientifically as well as practically; they are Farnham who testified at the trial, App. 25, Tr. 29, etc., Beesley, one of the applicants, App. 82, Dep. 2, etc., and Larsen, App. 90, Dep. 19, etc. Farnham was cross-examined in court, not only on his own testimony but on the facts brought out in the depositions of Beesley and Larsen, and it was so stipulated, App. 133.

That status is further substantiated by patents and a publication introduced by Plaintiff, and even by the Stern Bureau of Mines Report, Def. Ex. D, App. 201, also relied on by the Patent Office.

Well Drilling Procedures Employing Drilling Fluids.

A well drilling rig of the rotary type is illustrated in Plaintiff's Ex. 2, App. 147, explained by Farnham, App. 26, Tr. 30, etc., but the various parts are designated so as to be readily understandable. Briefly a rotary system comprises a drill pipe having a bit at the bottom larger than the drill pipe to make a hole larger than the drill pipe. At the top is a drill stem of squared section sliding through a rotary table, and with the whole suspended so that it can be let down into the bore hole. A drilling fluid is pumped down the drill pipe, issuing at the bottom through holes in the bit; the drilling fluid then rises outside of the drill pipe carrying the cuttings with it, so that when issuing at the top the fluid flows along a mud ditch and over a vibrating screen in order to deposit and take out the cuttings. The drilling fluid then passes to a suction pit where it is again picked up by the mud pumps for recirculation. As Farnham explains, App. 28, Tr. 34, the suction pit is connected with a supply of drilling fluid of from 1000 to 2000 barrels capacity.

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* That is in accordance with the Chapman Patent 2,399,986, Pl. Ex. 14, App. 189.

The specification, Pl. Ex. 1, states, p. 2, App. 133, 134:

> ". . . Such a drilling fluid, having a water as a phase, usually contains also a clayey component, either when made up, or when supplied in the course of drilling, from the formation being drilled or when added. Such a fluid may also contain a concentrated colloidal clay such as bentonite, fuller's earth, and/or a weighting material, such as barytes. . . ."

The above was confirmed by Farnham, App. 26, etc., Tr. 31, etc., who further showed that a drilling fluid is **a dynamic thing**—not a static thing. Its viscosity or consistency is very **critical**; for if the drilling fluid is too viscous or thick then it can not be pumped and will not deposit its cuttings, but if too thin, it will not bring the cuttings out of the well. That was conceded by the Examiner, Def. Ex. F, App. 209. Clays are used to impart viscosity characteristics and a highly colloidal or gel-forming clay (forming a gel—jelly) is bentonite. If a drilling fluid becomes too thick, it has been the practice since 1931 to thin it with a solution of caustic soda and quebracho, the latter being a tannic acid, App. 28, Tr. 33. Farnham is supported by the Lawton et al. patent 1,999,766, Pl. Ex. 11, App. 183, filed in 1931, hereafter discussed p. 21, infra.* The viscosity must be kept within rather close limits determined by standard testing instruments; Farnham App. 29, Tr. 36.

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* A drilling fluid made up of water, a high percentage of bentonite and caustic soda and quebracho for drilling through heaving shale, is what is described in the Cannon patent 2,109,858, Def. Ex. A, App. 193, relied on by the Patent Office.

During the course of drilling, however, the drilling fluid **does not remain static**; Farnham testified, App. 30, Tr. 37:

> "The drilling mud is constantly changing in composition, first because of the cuttings that are incorporated in the mud, not all of them being settled out or screened out. Some of the cuttings there form rather colloidal gels that are incorporated in the mud. Also, ground water will seep into your drilling mud from the exposed surface of the bore hole. To offset that, the drilling mud engineer will add water or weighting material or clays, or treating chemicals at the surface, and more or less continually."

As noted above, one of the important required characteristics of a drilling fluid is that it must wall or **seal up** the bore hole wall. That was discussed by Farnham, App. 31, etc., Tr. 38, etc. That action is brought about by a filtering action, with water from the drilling fluid passing into the formation leaving the clay behind. That is necessary in order to prevent the pressure in a formation being drilled from blowing the drilling fluid out of the hole. That must however be again controlled when a producing formation is penetrated. Farnham testifies, App. 31, Tr. 38-39:

> "There will be a flow of water filtered from the mud into the producing horizon. That must be kept at a minimum, otherwise the water will force the oil and gas back so far that it can never be produced, or it will greatly reduce the rate of production, so we choose there to add increased quantities of gel forming colloids to the mud, and thereby reduce the amount of water that will go into the producing formation."

That passage of water from a drilling fluid is called "**water loss**" and is tested by a standard device and measured in cubic centimeters, abbreviated as "**c. c.**", App. 31-32, Tr. 39-40.

Now ordinary clay, while useful, results in a high water loss, 20-35 c. c.; bentonite is much better and has a lower water loss, i. e., of about 10 to 15 c. c. However, both clay and bentonite are affected by salts in the water, which tend to flocculate the same, causing an abrupt increase in water loss, 125-150 c. c. Moreover, a water loss below 10 c. c. is very desirable, that is to **3 or 5 c. c.**; in fact in some fields such a low water loss is even mandatory, Farnham, App. 37, Tr. 48; see also Beesley, App. 89, Dep. 15, and Def. Ex. F, App. 204, 209.

The viscosity must be maintained "at an operable well drilling viscosity" (claims) as Farnham showed, App. 27, 29, Tr. 32, 36, and that must be so at a low water loss, viz., "below 5 c. c." (claim), App. 53, 55, Tr. 80, 84; see also Def. Ex. F, App. 204, 209.

From the above it will be seen that "an aqueous well drilling fluid" (claims) is not a static thing, but **a dynamic thing** which must be controlled. It is **actually a tool** because it acts as a conveyor for the cuttings and acts to seal the walls of the bore hole.

The Advent of Starch in Well Drilling Fluids.

Starch was mentioned for use in well drilling fluids as early as 1935, application 1929, in the Harth patent 1,991,637, Pl. Ex. 8, App. 177, page 2 right, line 62, granted to plaintiff's subsidiary App. 100, Dep. 36. It was also mentioned as "starch" in the Cannon patent 2,109,858, Def. Ex. A, App. 193, page 2 left, line 4, granted in 1938, filed 1935.

Now starch itself is inert and will not accomplish anything when added to a drilling fluid; Farnham, App. 36, 44-45, 47, 60, 61; Tr. 47, 67, 70, 92, 93; Larsen, App. 100, 106, Dep. 35, 45; Gray et al., paper Pl. Ex. 7, App. 159, page 4 right; Chapman patent, Pl. Ex. 14, App. 189, page

1 right, lines 1 and 2; Stern Report, Def. Ex. D, App. 202, page 78 at top.

In order therefore to be useful, **gelatinized** or hydrolyzed starch must be used; see above citations. That should be kept in mind, because that is what the application in suit specifies. The term in the claims is "**starchy colloid**", defined in the specification Pl. Ex. 1, App. 133, page 3, as "gelatinized starch". That was confirmed by Farnham, App. 71, Tr. 110; indeed the Examiner so understood it, Def. Ex. F., App. 204, 208. The specification gives various ways of producing it, Pl. Ex. 1, App. 134.

Now gelatinized starch per se was not new with the applicants, for it is described in the **Marsden patent** 376,445 of 1888, Pl. Ex. 11, App. 183, describing its preparation by treating raw starch with 1% solution of caustic soda in water, with a **ratio** of **10** parts of starch to **1** part of caustic. That was taught as a general thing in college; App. 33, Tr. 42-43. That ratio of **10 to 1** should be kept in mind in a consideration of the Stern Report, Def. Ex. D, App. 201.

Nor was the employment of gelatinized starch in drilling fluids new with the applicants; for such use was described in the Gray et al., paper of 1941, Pl. Ex. 7, App. 159, page 4, in the Chapman patent, Pl. Ex. 14, App. 189, filed in 1941, page 3 right, line 25; and in the Stern Report, Def. Ex. D, App. 201, page 78. All of these described the **10 to 1** ratio as in the Marsden patent.

Plaintiff's company started active investigation of the use of gelatinized starch from 1939 to 1940; Larsen, App. 102, Dep. 38, and began selling gelatinized starch to the drilling industry in 1941; App. 34, Tr. 43, where Farnham testified:

> "We had mediocre success in West Texas and New Mexico. The starch treated muds would **ferment**, unless the mud was saturated with salt as the result of

> drilling through the rock salt. After the salt was cast off and the percentage of salt dropped in the mud to less than saturation, it would ferment and would be abandoned. For that reason our **sales were confined** to West Texas, New Mexico, and just sparsely in the Gulf Coast and Mid-Continent region."

This fermentation was caused by "wild yeast", and although a strong "bug killer", creosote, was tried, that did not stop fermentation; Farnham, App. 34, Tr. 44; Beesley, App. 87, Dep. 11, Pl. Ex. 1, App. 133, 136. There were **just occasional sales** before 1943 and that only in regions where the drilling fluids "muds were saturated with salt"; App. 34, 39, Tr. 44, 56. Where the drilling was not in a salt area, gelatinized starch was tried; but as Farnham testified, App. 39-40, Tr. 56-57:

> "Yes, we used them. You can see from the tonnage that was most infrequent, and every one of them gave us trouble . . .
>
> Well, it takes about four or five days for fermentation to start, and we hope to finish our job before that elapsed time. If we didn't we had to throw the mud away . . .
>
> It takes anywhere from 20 days to several hundred days, but this application in the Gulf Coast, just at the finish of the well, we hoped to get it finished before fermentation."

It will be noted that the use of gelatinized starch in a concentrated salt drilling fluid is described in the following: Gray et al. paper, Pl. Ex. 7, App. 159; Chapman patent, Pl. Ex. 14, App. 189; Stern Report, Def. Ex. D, App. 201. That practice is acknowledged in the specification, Pl. Ex. 1, App. 133, 135, even by the addition of salt, but its drawbacks were stated as follows:

> ". . . while common salt may be added to fresh water drilling fluids, this deterioration and fermentation are not effectively inhibited; moreover, the latter

> procedure requires large quantities of salt and is, therefore, expensive, while the brine has a **corrosive effect** upon the equipment and has an effect of flocculating the cheaper clay colloids employed. In drilling fluids employing starch, in an aqueous phase of fresh water, or salt water, particularly of lower salt contents, in the course of time, deterioration of the starch may, therefore, so progress as to require frequent additions of starch, and this can only be continued to a limited extent; for deterioration will sometimes proceed faster than the starch is added."

Applicants' Invention.

The invention of the application in suit is **based on a discovery**, that if a well-drilling fluid is brought to a high degree of alkalinity, viz., **a pH of about 12**, and **maintained** at that alkalinity during the course of drilling, then starch can be added in amounts sufficient to attain a water loss of **below 5 cc.** and at an **operative** drilling viscosity without any deterioration of the starchy colloid by fermentation.

The symbol pH means hydrogen-ion concentration. It denotes the acidity or alkalinity of watery solution and is expressed by the pH value. It was explained by Larsen, App. 95, Dep. 27.

The specification states, Pl. Ex. 1, App. 133, 138:

> "We have found that when the alkalinity of a well-drilling fluid is established and thereafter maintained at **a pH of about 12**, then starch may be incorporated in such a fluid, and it will continue to function as a sealing medium without substantial deterioration or attendant fermentation. Moreover, we have found that, under such conditions, the water loss will decrease with additions of starch, to a point where it **approaches zero water** loss, and all without substantial deterioration or fermentation, so that the low

> water loss is **not only attained but is maintained.** The above is not only true of a drilling fluid whose aqueous phase is fresh water, but salt water as well, and to a fluid whose solid phase is clay, bentonite or fuller's earth."

The claims use the expression, "a pH of about 12." The specification states, Pl. Ex. 1, pp. 7 and 8, App. 133, 139:

> "The pH may be slightly below 12, thus a pH of **11.7** is in many cases sufficient. The pH may also be above 12, although that requires rapidly increasing quantities of the alkali as the pH is increased. We have, however, found that generally the pH should not be above **13.3**, because it appears that above that point the starch tends to begin to become less effective."

From the above it will appear that there **is a lower limit** of pH of **11.7** as well as **an upper limit of 13.3** which is something which should be kept in mind in the consideration of the Cannon patent, Def. Ex. D, App. 201, because as shown by Farnham, App. 77-78, 78-80, Tr. 134-135, 136-139, confirming Larsen, App. 130, Dep. 85, when the upper limit is exceeded caramelization of the starch and its reduction to sugar begins to take place that will defeat the very purpose of the use of gelatinized starch.

While, of course, a theory of action need not be understood and, of course, is not restrictive, the specification states, Pl. Ex. 1, App. 133, 139, p. 7:

> "One of the reasons for the advantageous effects, brought about by maintaining a drilling fluid at the above noted high pH, is believed to be due to the fact that the starch-splitting **enzymes** are rendered innocuous at a pH of about 12. While the bacteria are probably killed at a pH of somewhat below 12, this is not sufficient, for the **enzymes** apparently act as catalysts and may still remain effective. At a pH of about 12, the results seem to show that, in a drilling fluid, the **enzymes** are apparently rendered incapable

> of bringing about deterioration of the starch or fermentation of the drilling fluid."

The above affirms what we have previously said, namely: that it is not sufficient to prevent fermentation of the starch by adding sufficient to kill bacteria by an agent such as creosote, but it must be enough to render the enzymes inactive. The pH must therefore be **maintained.**

The pH or alkalinity of the drilling fluid may be brought about by various chemicals, thus the specification, Pl. Ex. 1, App. 133, 139, mentions not only the related caustics, namely caustic soda, caustic potash, caustic lithium and caustic ammonia, but also the very cheap lime and even soda ash.

The drawing, Pl. Ex. 1A, App. 145, shows the reduction in water loss from a high point to a very low point, indeed to practically zero, even where starch is used in connection with a clay. The curve marked "water loss" drops rapidly from a high water loss of 50 cc. to a water loss of **5 cc.** by the use of about 7 pounds per barrel of starch, that is, about 1½%, as related to the drilling fluid, but at an **operable viscosity** of about 30 centipoises, all as described in the specification, Pl. Ex. 1, App. 133, 141. The specification, however states, App. 141:

> "In accordance with this invention a water loss **approaching zero** may be attained, and in practice a water loss of 0.5 cc (30 minutes) has been attained, and a water loss below 3 cc (30 minutes) is readily attained. As will be seen from the drawing, the amount of starch required to secure resultant decreases in water loss, increases rapidly below 10 cc, so that economic considerations govern the end to be attained. In general, however, the attainments of a water loss of less than 5 cc is highly desirable."

Now it is **not only necessary to bring** the drilling fluid at a well to a pH of about 12, but it is **necessary to maintain** that pH, because of the continuous introduction of clay, salts and water to the drilling fluid reducing the alkalinity by the addition of inert or acid materials. That is brought out in the specification, Pl. Ex. 1, App. 133, 143, as follows:

> "There should, of course, be observations of the pH and water loss as the drilling proceeds, with additions of alkali and starch when required to maintain the pH at about 12 and to maintain the low water-loss."

The utility of the maintenance of a drilling fluid at a pH of about 12 with a starch colloid as employed is striking from other standpoints. Thus in the drilling of a well, it is frequently necessary to **cement** the casing in place in order to shut off a particular formation or strata. This cement must then be drilled out when drilling is proceeded with, resulting in incorporation of complex calcium compounds of the cement by which the drilling fluid is rendered too highly alkaline.† In this case, however, **that very cement is made useful**, converting what was considered **a vice into a virtue**; thus the specification says, Pl. Ex. 1, App. 133:

> "Because of the fact that amylaceous colloids, such as starch, etc., are particularly effective when employed with the drilling fluid **maintained** at a pH of about 12, these may be employed in the treatment of cement-cut muds; for the presence of the cement will not now be harmful but beneficial, because of the elevation of the pH by the cement."

Again gypsum (calcium sulfate) occurring as a contaminate in a drilling fluid is detrimental. However, in applicants' process, the gypsum is converted into something else, namely, sodium sulfate, which is not so detrimental, but the calcium will now be converted to lime, which, as the specification says, Pl. Ex. 1, p. 11, App. 133, 142, "lime is **useful** in maintaining alkalinity."

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† See In re Jones, 120 F. 2d 1019, CCPA.

The Claims Are Consonant With Applicants' Invention.

This is not a case where we are attempting to obtain claims of unlimited scope. Indeed, the claims are modest. The broadest one reads as follows, App. 212:

> "Claim 3. In the art of drilling wells by the employment of an aqueous mud-laden drilling fluid, the process comprising, adding to such a fluid, **while maintained** at a pH of **about 12**, sufficient of a **starchy colloid** to attain and **maintain** a substantial wall-seal of **low water** loss, viz., below 5 cc (A. P. I.) and at **an operable** well-drilling viscosity." *

The claim is **not simply** for the **employment** of a starchy colloid, that is, gelatinized starch, in a drilling fluid; they are **not simply** for **maintaining** a drilling fluid at a pH of about 12 and then using such a starchy colloid in such a fluid; but they go so far as to specify that the pH is "**maintained**" and that sufficient of the starchy colloid is added to "maintain" a substantial water loss, viz., below 5 cc and withall "at an operable well-drilling viscosity."

The remaining claims are successively more specific than claim 3, and in accordance with the usual practice in the Patent Office, are allowable as successively more restricted claims; in fact, the Patent Office has not objected that the claims are unnecessarily multiplied.

The Prior Art Cited by the Examiner.

The Patent Office relies upon a Stern Bureau of Mines Report of February, 1941, Def. Ex. D, App. 201, and a Cannon patent, 2,109,858, of March 1, 1938, Def. Ex. A, App. 193. The other references, Def. Ex. B, App. 197, Chemicals by Glyco, and Def. Ex. C, the Solvay Blue Book, App. 199, are only relied upon to show how much caustic soda is necessary to produce a particular pH in water;

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* As shown later, pp. 27-28, infra, when starch is substituted for quebracho in the Cannon patent examples, the fluid becomes so viscous that it is not usable as a drilling fluid.

we can assume that those publications are correct in that respect.

We can even assume as to Stern that a 1% solution of caustic soda in water, at a 10 to 1 ratio of starch to caustic soda, will gelatinize raw starch; indeed we showed, p. 7, supra, that that was known from 1888 on. We can also assume as to Cannon that 2% of caustic in a drilling fluid will attain a pH in excess of 12, but that we will show will result in something which will not be usable, while 7% caustic given by Cannon will give a pH of [redacted] 13.7 which is so far in excess of the upper limit of [redacted] 13.3 given in the specification as to result in caramelization of the starch, see p. 29, infra.

The Examiner's Statement admits, Def. Ex. F, App. 204, 209:

> "All the claims stand finally rejected as being unpatentable over the Cannon patent and over the Stern patent (Report). **The Examiner does not contend that these references teach the basic principle of applicants' discovery** * * *"

As we have noted previously, the invention in suit is based on **a discovery** embodied in a definite process as specified in the claims.

Summary—Stern and Cannon.

We want to first summarize what is and what is not disclosed in the Stern Report and in the Cannon patent as follows:

(1) **As to Stern:** that the part relied upon by the Examiner, Def. Ex. F, App. 204, has reference to the preparation of gelatinized starch from raw starch by a 10 to 1 ratio of starch and caustic soda (sodium hydroxide) in water and the resultant pH of that preparation before addition to the drilling fluid. It has no reference to the pH of the drilling fluid after such addition; that is not given at all, but that is specified in the claims of the application in suit.

(2) **As to Cannon: First,** there is no disclosure in that patent of the employment of gelatinized starch as distinguished from raw starch in place of quebracho; **Second,** starch and quebracho are not equivalents but one is the very antithesis of the other; **Third,** that if it is attempted to substitute even raw starch for quebracho extract in the same proportions as given in the Cannon patent, then a fluid will be produced which is absolutely unusable as a drilling fluid, because it will be so thick and viscous that it will not be "at an operable well drilling viscosity," as specified in the claims; **Fourth,** if the minimum percentage ⅓% of caustic soda given in the Cannon patent is followed, then that will not produce gelatinized starch; **Fifth,** if the maximum percentage, 7% of caustic soda given in the Cannon patent is followed, then the starch will carmelize and become ineffective; **Sixth,** the Cannon patent is directed to an entirely different thing than is applicants' invention, namely, using a very high percentage 10-30% of bentonite and reducing the viscosity by a corresponding high percentage of caustic soda and tannin; **Seventh,** if in such a case starch be substituted for tannin, the viscosity will not be reduced but increased to an extent where the resulting drilling fluid will be unusable; **Eighth,** lime cannot be substituted for caustic at all, because lime will not gelatinize starch.

In the consideration of any particular prior art writing, whether a publication or a patent, it is no more than common sense that the same be considered in its environment and in a manner as one skilled in the art would consider it with what was previously known. We will so consider the Stern Report and the Cannon patent. In doing so some of the presentation may appear argumentative, but that is done to connect the facts.

The Stern Report of February, 1941.

The publication is, as its title shows, App. 201, a "Report of Investigation" of the Bureau of Mines, showing the state of the art as it existed in February, 1941; accordingly it contains foot notes showing where the information was obtained. What Stern actually did was to canvass the prior art as found in the then existing patents, publications and usage; that appears from text and the foot notes in the Report. Stern had actually canvassed the Gulf Coast and California oil fields; Farnham, App. 41, Tr. 61, etc.; Larsen, App. 116, Dep. 63. Stern's report is dated the same year and month when Gray et al. presented their paper, Pl. Ex. 7, App. 159.

The part relied on by the Examiner, Def. Ex. F, App. 204, 211, reads as follows:

> "It is only recently that starch has found application in drilling muds as a result of the development that hydrolyzed starch imparts a good filter test to salt-water mud. For this purpose the starch may be hydrolyzed by boiling a 10-percent starch suspension in sodium hydroxide (1 percent by weight; or starch: sodium hydroxide 10:1). A pH of about 11 or 12 has been found desirable."

It will immediately be apparent that with the exception of the last sentence, **Stern gives the very 10 to 1 ratio of starch and caustic soda which had been usual in the gelatinization** of starch from 1888 on as described by Marsden in 1888, Pl. Ex. 10, App. 181 (see p. 7, supra), and the procedure actually employed in 1941 in gelatinizing starch for addition to drilling fluids; Farnham, App. 41, Tr. 62; Gray et al., paper of February, 1941, Pl. Ex. 7, App. 159, pages 4 and 7; Chapman patent, Pl. Ex. 14, filed 1940, App. 189, page 1 right, lines 20, etc. That it is such a **10 to 1 mixture** which is **added to the drilling** fluid is particularly described **by Gray** et al., App. 159, 166, page 7 right, as follows:

> "Use of Starch in Field Tests.
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> "The first field trial of gelatinized starch was made on a well in the same area as that of the gum tests. In

> preparing the pasted starch for field use, a box fitted with perforated steam coils was employed. Starch was intimately mixed with water by adding the starch through a mud-mixing hopper. Caustic soda was added, and the white, pasty mass was agitated with steam until a viscous, straw-colored suspension resulted. The final composition of the mixture was approximately **89** per cent water, **10** per cent cornstarch and **1** per cent caustic soda. The mud in the pit was stirred vigorously with the guns while the starch suspension was added."

Obviously, the last sentence by Stern: "a pH of about 11 or 12 has been found desirable" simply means the **pH of the 10 to 1** starch-caustic mix, and not that of the drilling fluid to which it is then added. That is confirmed by Dodge, highly skilled in this art, Pl. Ex. 3, App. 149, 153. As Farnham testified, App. 45-46, Tr. 68-69, starch will be gelatinized at a pH of 11 in a caustic soda solution if it is boiled. Farnham then testified, App. 46, Tr. 68-69:

> "Q. Summarized, then, what do you gather from that statement about the 10 to 1 ratio and about the pH? A. Mr. Stern is telling what he has seen in the fields. He is describing the method of hydrolyzing ordinary corn starch. They make up a 1 per cent caustic water mixture, add the corn starch to it, and cook it until it gelatinizes. That is the mixture that is added to the mud, and the pH of this mixture while it is cooking may be between 11 and 12."

All of that is even confirmed by the Stern Report, Def. Ex. D, App. 201, 203, page 77, where after describing the preparation of gelatinized or hydrolyzed starch and the last sentence "a pH of about 11 or 12 has been found desirable," in the very next paragraph Stern says:

> "One important point is that starch tends to ferment unless a preservative is added. An effective **preservative** is **sodium chloride (salt)**, so that it is possible to

> accomplish a dual function when drilling through a salt formation. The salt does not flocculate the hydrolyzed colloidal starch suspension, so that the desirable qualities of the mud are not destroyed, and the salt that does enter the mud acts as a preservative to prevent the fermentation of starch.''

That is exactly what was described in the Gray et al. paper, previously quoted, pp. 16-17, supra, and which paper was presented in the same year as the Stern Report, which even has a footnote (10) citing, "Cannon, George E. Humble Oil and Refining Co., Houston, Texas,'' whose engineers presented the Gray et al. paper. The only other preservative mentioned by Stern is "an alcohol."

The Stern Report is **utterly silent** on a procedure of maintaining the **drilling fluid** at a **pH of about 12** (11.7-13.2) as specified in the application in suit.

The Examiner proceeding with his confession and avoidance, now proceeds to deduce the following, Def. Ex. F, App. 204, 211:

> ''Applicants do not dispute the fact that a 1% sodium hydroxide solution would have a pH of about 12. From the graph on page 50 of the Solvay Blue Book it appears that a 1% caustic soda solution would have a pH of about 12.95 at 86° F. Applicants contend that the statement 'a pH of about 11 or 12 has been found desirable' means that the pH of the starch-caustic soda mixture should be 11 or 12 and not that the pH of the mud to which it is added must be 11 or 12. The Examiner is convinced that it is the pH of the mud that is referred to. When you specify the amounts of sodium hydroxide, water and starch, the pH is fixed. A 1% solution of sodium hydroxide (caustic soda) must necessarily have a pH of about 12.95. The presence of the starch will not materially change the pH. Therefore the only composition whose pH could vary is the finished mud, and this is what

> Stern must be referring to when he states that a pH of 11 or 12 has been found desirable. If a condition is stated as being desirable, this presupposes a choice, a possibility that conditions may be varied. Since the starch-caustic soda mixture cannot vary in pH, Stern must have meant that the drilling mud could be adjusted to the most desirable pH of 11 or 12."

In other words, the Examiner **deduces** that adding a gelatinized starch suspension of a given pH value (12.95), but in an **unstated** amount to a drilling fluid of an **unstated** amount, a **certain** result will be secured, namely: a drilling fluid at a pH of 12; that is, that an **unknown plus an unknown will produce something certain.** The Examiner has entirely neglected the fact that there must be **dilution** of the gelatinized suspension in the drilling fluid resulting in a lowering of the pH depending upon the proportion of the suspension to the drilling fluid, to say nothing of continuous dilution during the course of drilling. As Farnham testified, App. 28, Tr. 34, the volume of the drilling fluid or "mud" in a drilling system is **1000** to **2000** barrels plus **500** to **800** barrels, that is, it is variable, with a **variable dilution** depending again upon the percentage of the gelatinized suspension added to the system, so that the pH of the drilling fluid is not fixed but variable.

To illustrate the above, Larsen took a series of mud fluids in accordance with the Field Tests given in the Gray et al. paper, Pl. Ex. 7, App. 159, 166-167, pages 7 and 8, which he testified was the practice which he had seen carried out at that time in a Texas well; App. 120, Dep. 69. Larsen prepared three drilling fluids with clays then used in that area, App. 120, etc., Tr. 69, etc., and treated them with varying proportions of a gelatinized starch suspension prepared as specified by Gray et al. and also by Stern, i. e., by a **10 to 1** ratio of starch to caustic soda. Two of these fluids were concentrated salt drilling fluids and one was a fresh water drilling fluid. The preparation of the **gelatinized starch suspension** having a pH of 12.5-

12.7, App. 120, Dep. 70, and their addition to the three drilling fluids are given in Pl. Ex. 5, App. 155, together with the resulting pH values and water loss values. Larsen detailed the tests further, App. 120 to 123, Dep. 69-75, and he was confirmed by Farnham at the trial, App. 50 to 51, Tr. 75-77. Those tests were not disputed at the trial by Defendant's attorney; in fact Farnham was not cross-examined on those tests at all, although the Stipulation, App. 133, permitted Farnham to be cross-examined even on Larsen's deposition.

Larsen's Tests Show the Following:

First, the **pH** of the drilling fluid **varies** by the addition of successive additions of the gelatinized starch suspensions, having an original pH of 12.5-12.7, as will indeed be obvious, because of **dilution**, although the Examiner apparently did not appreciate the obvious.

Second, even the Field Tests given in the Gray et al. paper, contemporaneous with the Stern Report, show that they did not carry the pH beyond **11.2**, before aging, or beyond **10.8**, after aging, in accordance with standard tests to approximating well conditions, Larsen, App. 122, Dep. 72, Farnham, App. 50-51, Tr. 75-76. There would, of course, be no fermentation of the **salt water** drilling fluids (a) and (b), because the salt water acted as a preservative as shown by Larsen, App. 123, Dep. 74; and also by Stern, Pl. Ex. D, App. 201.

Third, a fresh water mud fluid (c) was likewise treated and that was more favorable to attaining a higher pH than in the case of salt water mud fluid as shown by Larsen, App. 121, Dep. 70, and by Farnham, App. 50-51, Tr. 76, and by the fact that the pH after aging is higher. While that fresh water mud fluid attained a water loss of 6.2 c. c. at a pH of **10.9**, which water loss is close enough to 5 c. c. (claims) as admitted by Larsen, App. 124, Dep. 75; he testified, App. 123, Dep. 73-74, that a pH of 10.9 is **not high enough to inhibit fermenting** but that to prevent that the pH has to be above 11.5, which is not simply a difference between 10.9 and 11.5, because the pH scale is **logarithmic** so that there is rapid increase of alkalinity, Farnham, App. 81, Tr. 140, confirmed Larsen, App. 113, Dep. 57.

The above testimony, **not disputed at the trial**, was in answer to the Examiner's procedure of confession and avoidance by deductions with no evidence by the Patent Office to support the Examiner.

The Cannon Patent 2,109,858.

Before proceeding with the Cannon patent disclosure, we want to note here also **the environment** so as to place that patent in its **proper niche** in the art. That is because the Cannon patent deals with a water-bentonite drilling fluid which is **thinned** by caustic soda and a tannic acid such as quebracho extract, at a concentration to permit a large percentage of bentonite to be employed. The Examiner seeks to spell out applicant's invention by substituting starch for bentonite, because "starch" (not gelatinized starch) is mentioned in the patent, although the only examples given specify only a tannic acid, specifically quebracho extract, a crude tannic acid.

Farnham testified, App. 27-28, Tr. 32-34, that to his knowledge for over 21 years bentonite has been used in drilling fluids to increase its viscosity,* and that as early as 1931 a caustic and quebracho solution has been used to thin a drilling fluid when it became too thick. Farnham later, App. 57, etc., Tr. 87, etc., identifies the Lawton et al. patent as disclosing such thinner.

The Lawton et al. Patent 1,999,766, Pl. Ex. 11, App. 183, granted in 1935, filed in 1931, discloses a drilling fluid of water and "a large proportion of clay", page 1 right, line 6, including a "prepared bentonite in 5 to 10 per cent suspension in water", page 2 left, line 41. It further describes the addition to the drilling fluid of

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* That is confirmed by the Harth patent, 1,991,637, App. 177.

> ". . . a solution of 3 parts caustic soda and 1 part tannic acid . . . amounts to about 0.25 to 1% by weight on the solids in the drilling fluid, or about 6 to 25 pounds per 1000 gallons of a drilling fluid weighing 9.5 pounds per gallon." Page 3 left, lines 35, etc.

That is stated, page 4 right, line 3, to effect a "reduction in viscosity" of the drilling fluid. The above proportions of caustic soda and tannic acid are also specified in Claim 5, page 4 right.

From the above Larsen calculated, App. 115, Dep. 60, that the caustic soda specified by Lawton et al. was **1/5 of 1%** of the weight of the drilling fluid; that was confirmed by Farnham, App. 58, Tr. 88; and that was not disputed by Defendant's counsel at the trial.

We have noted the above to show that as early as 1931 and since, a solution of caustic soda and tannic acid was employed to reduce the viscosity or plasticity of a drilling fluid, even one containing as much as 10% bentonite, and that the caustic soda employed was 1/5 of 1%. That is pertinent in the consideration of the Cannon patent which specifies a drilling fluid containing from 10-30% of bentonite and whose plasticity is reduced by caustic soda and tannic acid and with the caustic soda **1/3 of 1%**. This observation is made in order to show that the Patent Office did not appreciate the status of the Cannon patent in the art.

The Cannon Patent, App. 193, as appears from the title is for "Drilling Fluid for Combating Heaving Shale." That is described by Cannon as follows, p. 1 left, lines 36-41:

> ". . . A heaving shale may be defined as one which in contact with the ordinary drilling mud swells or disintegrates spontaneously so much as to interfere with the drilling operation. It is highly sensitive to water; also it is highly colloidal."

Cannon previously stated, p. 1 left, lines 30-36:

> ". . . This shale has a tendency to move into the hole, filling up the hole already drilled and often sticking the drilling tools. Although the cause of this action is not thoroughly understood, it is believed due to the hydration of the shale particles by the water in ordinary drilling muds."

That is confirmed by Farnham, App. 56, Tr. 86.
Cannon then states, p. 1 left, lines 42-52:

> "In accordance with the present invention, the disintegration of a heaving shale is prevented by addition to an ordinary drilling mud of a high concentration of addition or treating agents which when used alone tend to **reduce the viscosity** and prevent the gelation of the usual clay mud, and in turn adding to the thus treated drilling mud a plasticizer, such as bentonite for the purpose of avoiding the deleterious effect of the excess treating agent on the clay in the mud which would otherwise be encountered."

Cannon employs a mixture of caustic soda, quebracho extract and bentonite all in large quantities. It is stated, p. 2 right, line 71, p. 3 left, line 11:

> ". . . Sufficient bentonite is present in the drilling mud to render the mud excessively plastic, except that its **plasticity is reduced** by the addition of the **tannic acid or the like plus alkali** in such amounts that the resulting drilling fluid does not attack the heaving shale."

It will be apparent from the above that the quebracho extract actually performs the **same function** as it always did, for instance in the **Lawton** et al. patent, 1,999,766, Pl. Ex. 12, App. 187, that is to **reduce the viscosity** of the drilling fluid. Of course, the caustic and quebracho together form a viscosity-reducing agent, being used in larger quantities as usual, because of the large proportion of bentonite, namely, 10-30% as distinguished from the usual 3-5%, Farnham, App. 56-57, Tr. 86-87. The Examiner really concedes the above in a reverse way when he says, Def. Ex. F, App. 204, 210, p. 5:

> ". . . In order to make up for the excessive thinning of the mud by these abnormally large amounts of 'treating agents', correspondingly large amounts of bentonite, or other colloidal materials are added to the mud."

However, as noted above, Lawton et al. employ from 5-10% bentonite, thinned by a caustic soda-tannin solution, with the caustic as much as 1/5 of 1% as related to 1/3 of 1% as disclosed by Cannon six times in this specification and in his claims; p. 2 right, lines 14, 41, 59, 62, page 3 left line 24 and right line 20. That distinction is really one of arithmetic; Farnham, App. 65-66, Tr. 101; Larsen, App. 115, Dep. 60.

We have detailed the above, because the Examiner later flatly asserts, Def. Ex. F, App. 210:

> ". . . Cannon does not use the starch or quebracho to reduce the viscosity. He states that he uses these materials, which ordinarily reduce the viscosity, in amounts 'at least fifty to one hundred times as high' as would be ordinarily used to reduce the viscosity (page 1, columne 2, lines 9 to 13). Therefore, in following the teaching of the Cannon patent, you would use the same amounts that applicants suggest using and these amounts would be within the range in the present claims."

It will be noted that the first sentence is directly **contrary** to what the Cannon patent specifically says and what the Examiner conceded in the extracts just quoted. The quotation from the second sentence is partial and is not in accordance with the Cannon patent disclosure, which says, page 1 right, lines 9-13:

> ". . . At least fifty to one hundred times as high a percentage of treating agent and plasticizer is added

> as will ordinarily be used in controlling the viscosity and plasticity of the usual drilling mud."

The "treating agent" is the organic compound, viz., (quebracho-tannin) plus caustic soda (sodium hydroxide) and the "plasticizer" is bentonite; page 2 right, lines 33-37 and 42-47. Of these the bentonite is the preponderant part, viz., 10-30%, as to quebracho 1-2%, page 2 right. The latter is from 1/3 of 1% as compared to 1/5 of 1%, Larsen, App. 115, Dep. 60, as given in the Lawton et al. patent. Even at 2% given in the Cannon patent is **20** times and **not 50 to 100** times that given in the Lawton et al. patent. However, as noted above, it is the caustic soda which is stressed in the Cannon patent and that is from 1/3 of 1% as compared to the 1/5 of 1% of the Lawton et al. patent.

As to Starch. The Examiner now proceeding further with confession and avoidance attempts to show how Cannon can use "starch" in a drilling fluid "maintained at a pH of about 12" and in an amount sufficient to "maintain" a water loss "below 5 cc." as specified in the claims, proceeds as follows, Def. Ex. F, App. 204, 210:

> (1) "**Starch** is listed as an example . . ."
>
> (2) "The amount of caustic soda is such as to give a pH of about 12, to the mud."
>
> (3) "There has been disagreement between the Examiner and the applicants as to the amount of starch to be used according to the teaching of the Cannon patent."
>
> (4) "The Examiner contends that the amount is that equivalent to the amount of quebracho extract in the specific examples, which amount is 2%. The equivalent amount would also be about 2%."
>
> (5) "Therefore, in following the teaching of the Cannon patent, you would use the same amounts that applicants suggest using and these amounts would be within the range in the present claims."

(1) The first statement is correct, but applicants' specification and claims specify a "starchy colloid," i. e., **gelatinized starch**, and not "**starch**," which is **inert**, as we showed, p. 6, supra, starch and quebracho are **not equivalents**; Farnham, App. 64, Tr. 98; Larsen, App. 126, Dep. 80.

(2) If the second statement is assumed to be correct, then as will appear the Cannon disclosure becomes inoperable when starch is substituted for quebracho at a pH of about 12.

(3) The third statement will appear from (4).

(4) The fourth statement has no basis in the Cannon patent, but if such substitution be attempted, then the Cannon patent disclosure will become inoperable.

(5) The fifth statement must assume that starch and quebracho are equivalents, which they are not.

The above raised scientific questions as to which the Examiner had not cited any scientific authority. Plaintiff in order to meet even such a situation proceeded as follows:

At the trial **Farnham** made a few **simple demonstrations**, App. 60, etc., Tr. 91, etc., based on the substitution of 2% starch for 2% quebracho, which demonstrations were not disputed by the Commissioner's counsel, as follows:

> (1) Two bottles were exhibited each containing 10% **bentonite** dispersed in 90% water, which formed a rather **stiff gel**, and 10% bentonite is the lowest percentage of any of the Cannon examples.
>
> (2) 2% ungelatinized corn starch was placed in a bottle of water 98%; being inert it did not gel and did not go into solution but settled out.
>
> (3) 2% of **quebracho** extract in water 98% dissolved to form a solution.
>
> (4) to (3) That is quebracho in water, was added 2% of caustic soda which still resulted in a solution.

(5) to (2) The starch in water, was added 2% caustic soda which resulted in a rather stiff gel.

(6) (4) That is the quebracho and caustic in water was added to one of the (1) bottles containing 10% bentonite in water and it resulted in thinning of the fluid.

(7) (5) The gelatinized starch suspension was added to one of the (1) bottles containing 10% bentonite and resulted in thickening of the fluid.

Farnham was not cross-examined on those simple tests and the results were **not disputed** by Defendant.

Farnham at the trial took the Cannon patent example relied on by the Examiner, i. e., 2% starch substituted for 2% quebracho. However, Larsen took all of the Cannon patent examples and his results are given in Pl. Ex. 6, App. 157, and discussed by Larsen, App. 126, etc., Dep. 80, etc. The results of tests (A), (B), (C) and (D) show that wherever caustic soda is used with a tannic acid, **quebracho**, in the proportions given in the Cannon patent, in drilling fluids containing 10-30% bentonite, then in each case the drilling fluid will be at an **operable viscosity** because the fluid was thinned. Where, however, in the Cannon examples it is attempted to substitute **starch** for the tannic acid, then in each case the viscosity of the drilling fluid will be so high that it **could not be used at all**, because the fluid will be thickened and not thinned.

Larsen was confirmed by Farnham on those tests, App. 65, etc., Tr. 100, etc.; Farnham testified:

> "Q. Now, take that first one, where you used 1 gram of caustic, or the one where you used 2 grams of caustic, it doesn't make any difference, and where you use caustic with **quebracho** in A, B, C and D. They all worked, didn't they? A. Yes, these muds made up represented A, B, C, and D would be within a **usable viscosity range.**"

* * * * * * *

> "Q. Mr. Larsen took A, B, C and D and paralleled it by a, b, c, and d, and substituted **starch** for caustic (quebracho). Do any of those drilling fluids work? A. No, the viscosities are too high to measure on the Stormer Instrument, and any mud that high has a viscosity that **could not be pumped.**
>
> "Q. One of those experiments you performed shows what happened, doesn't it? A. Yes."

Again Larsen's tests were **not disputed** by the Commissioner's counsel who did **not even cross-examine** Farnham on them, although the Stipulation, App. 133, conceded the right to do so.

The results of the above tests are based upon the known scientific facts that while caustic soda plus a tannic acid operates to **thin** a drilling fluid, caustic soda plus starch will act as a **thickener.** Farnham testified, App. 64, Tr. 98-99:

> "Q. Can you, then, say that starch is a substitute for quebracho, used with caustic soda? A. No, it is **not a substitute.** It is just the opposite.
>
> Q. Do you know anything that could be on the opposite ends of a scale worse than trying to put starch on one end and quebracho on the other? A. No. It had just the **opposite effect.** Starch has the opposite effect of quebracho."

* * * * * * *

> "Q. But as soon as you substitute starch for quebracho, do you get what Cannon wants? A. No, **you get into trouble.**
>
> Q. Get in trouble right away, don't you? A. Yes.
>
> Q. In other words, it is correct to say it **would defeat** the very thing Cannon wanted to do. A. That is right" (App. 67, Tr. 103-104).

Assuming then for the moment that one following the Cannon patent would by some legerdemain produce a drilling fluid which although unusable would still have in it starch gelatinized in situ by caustic soda at a pH of about 12, what then?

Now Cannon gives as to caustic soda a minimum of ⅓ of 1% and a maximum of 7%, App. 193, page 2, right. But at the **lower limit starch will not gelatinize while at the upper limit it will caramelize.** That was shown by Farnham, App. 66, 77, Tr. 102, 134, etc., and by Larsen, App. 108-110, 128, Dep. 50-53, 83. As shown p. 10, supra, the application in suit is definite as to upper and lower limits of the pH, viz., 11.7-13.3.

It will, therefore, be seen that if we follow the Cannon patent as to the lower limit of ⅓ of 1% caustic that will not be sufficient to gelatinize starch; but if we follow Cannon as to the high 7% caustic then that will be too high and will result in caramelization of the starch.

Again, Cannon recommends the use of **lime** instead of caustic, p. 1, right, line 54. If, therefore, the Patent Office relies upon the substitution of starch for quebracho and the substitution of lime for caustic soda we will again get into trouble, because, as Larsen showed, App. 112-113, Dep. 57, by his test, Pl. Ex. 4, App. 154, **starch will not be gelatinized by lime** even if the fluid has an alkalinity of 12.4. That was confirmed by Farnham, App. 66-67, Tr. 103.

We have in addition the following of what others thought of the Cannon patent. Stern, in his Report, Def. Ex. D, App. 201, not only cites the Cannon patent on page 76, but also refers to Cannon p. 78. Stern says, pages 76 and 77:

> "Starch has been mentioned as a mud addition agent in the patent literature, notably by Harth (60) and Cannon (21). Harth mentioned it as an alternative for bentonite, while Cannon describes its use with high concentration of alkali for drilling through heaving shale.

> "Starch is inferior to bentonite in those muds in which bentonite is effective, namely, fresh-water mud. Neither starch nor bentonite is effective to prevent filtration in a salt-water mud."

That was in February, 1941. **Stern found no disclosure of gelatinized starch or of maintaining a drilling fluid at a pH of 12** in the Cannon patent: in fact, although the Cannon patent had issued in 1938, when Stern wrote his Report three years later Stern said in February, 1941:

> "It is only recently that starch has found application in drilling muds. * * *"

The Chapman patent 2,399,986, Pl. Ex. 14, App. 189, was issued in 1946 to the same oil company as was the Cannon patent. Now that Chapman patent 2,399,986 particularly refers to the Cannon patent 2,109,858 by quite an extensive discussion, p. 1 right, line 34, page 2 left, line 17.

As noted previously and as appears from the patent, page 1 right, lines 20, etc., Chapman first gelatinizes starch by a **10 to 1** ratio of raw starch to caustic, and such suspension or dispersion is then added to the drilling fluid or mud in the proportion of "1 barrel of the starch dispersion to even 10 barrels of the mud", page 2 left, lines 58, etc. However, as stated, page 2 left, lines 12, etc., "in the practice of the present invention, caustic enters the final drilling fluid **only incidentally**." That is because in accordance with the Chapman process fermentation of the gelatinized starch is prevented by the employment "of sufficient salt, either common salt or any other salt ordinarily having a deflocculating effect on clay suspensions to prevent fermentation of the salt." *

What Cannon's assignee found was disclosed in the Cannon patent as late as 1946 when the Chapman patent issued is stated as follows, page 1 right, lines 34-55:

> "The use of gelatinized starch prepared by treatment with caustic according to the present invention

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* That is, of course, what was described in the Stern Report.

> is not to be confused with the use of starch as a protective colloid in connection with drilling muds containing a high concentration of alkali. For example, in U. S. Patent 2,109,858 there is disclosed a drilling mud for heaving shale, the characteristic feature of which is the maintenance of high alkalinity, as by having caustic alkali present in the mud in an amount equal to at least ⅓ of 1% by weight of the total weight of the drilling mud. It will be understood that this percentage by weight is a minimum.
>
> "It was found that with such percentages of alkali in a conventional drilling mud, the solid constituents of the mud tended to be flocculated, so that a mud of undesirable consistency resulted. In order to avoid this flocculation, the patentee proposed to add a protective colloid to the mixture and indicated that this protective colloid should be used in an equal amount by weight with the caustic. * * *"

In other words, the caustic and the "protective colloid" are used by Cannon to avoid an "**undesirable consistency**" of the drilling fluid or mud, that is, to thin it, which will not be attained by gelatinized starch because it will thicken the fluid. Indeed Chapman in referring to the proportions of 2% and 7% given in the Cannon patent for Quebracho, which the Examiner wants to be substituted by starch, Chapman says, p. 2 left, lines 7, etc.:

> "If starch is used in connection with caustic in the manner proposed according to the present invention in the proportions of 2% by weight to 7% by weight, it not only does not retard loss of water by filtration, but actually has an adverse effect. * * *"

All of the above agrees with what Farnham and Larsen testified and what Farnham demonstrated in Court.

THE STATUTE INVOLVED.

The Statute involved is the familiar one, R. S. 4915; 35 U. S. C. 63.

STATEMENT OF POINTS.

(1) The testimony adduced at the trial shows clear error on the part of the Patent Office in refusing a patent to Plaintiff with the claims in issue and the claims define invention and are patentable over the prior art.

(2) The Stern Report does not disclose the subject-matter of the claims in suit, and it does not disclose a well drilling fluid maintained at a pH of about 12.

(3) The Cannon patent does not disclose the subject-matter of the claims in suit, and any attempted substitution of starch for quebracho renders Cannon's disclosure inoperable.

(4) The application in suit and the claims thereof involve a discovery in a process of treating well drilling fluids and not simply a property of the well drilling fluids of the Stern Report and of the Cannon patent.

(5) Plaintiff is entitled to a patent on the application in suit involving the claims thereof.

SUMMARY OF ARGUMENT.

The application in suit relates to the art or process of drilling wells by an aqueous well drilling fluid, in which a starchy colloid, i. e., gelatinized starch, is added to seal the walls of the bore hole. The characteristic feature resides in maintaining the alkalinity of the fluid at a high value specified in the claims, so as to maintain a wall seal with a specified low loss of water to the formation being penetrated, but at an operable well-drilling viscosity. Unless that high alkalinity is maintained during the course of drilling the fluid will ferment and become worthless. The process is based on a discovery, is of great importance to this art and has gone into wide use. All of that is conceded by the Patent Office. (See pages 2, etc., infra.)

The Patent Office has not cited any prior art disclosing the subject-matter of the claims in suit; for as conceded by the Patent Office as to the prior art relied on, "the Examiner does not contend that these references teach the basic principles of applicant's discovery."

The Patent Office relies on a Stern Report and a Cannon patent. These citations are summarized pages 14, etc., supra. In brief the Patent Office proceeded as follows:

As to the Stern Report, the Patent Office attempts to read into it the high alkalinity of the drilling fluid specified in the claims, although the Stern reference is to the alkalinity of the gelatinized starch suspension to be added to the drilling fluid; when so added, dilution will result so that the alkalinity will be reduced to a point where fermentation will take place.

As to the Cannon patent the Patent Office attempts to read into the patent gelatinized starch, specified in the claims as "starchy colloid", when the patent only mentions "starch" which is inert and performs no useful function, and when no examples of the use of starch are given. The Patent Office next seeks to substitute starch for quebracho in the Cannon process; although they are not equivalents but antithetical. Such attempted substitution will render the resulting drilling fluid inoperable and defeat the very objects and purposes of Cannon's process. The objects and purposes of the Cannon process are the very opposite of applicant's process. All that was recognized and well understood in the art.

The District Court disregarded the testimony of four highly skilled in this art witnesses, supported by patents and publications. That testimony was not refuted by the Patent Office. The Informal Memorandum and the Findings of Fact of the District Court are not supported by the evidence, but are contrary to the evidence. The Conclusions of Law of the District Court are not supported by law but are contrary to law, particularly as construed by the Supreme Court, this Court and by Courts in other Circuits.

ARGUMENT.

The Patent Office does not dispute that there was a problem in this art of drilling wells involving the use of gelatinized starch in well drilling fluids employed in such drilling, because of fermentation, and that the process described and claimed in the application in suit solved that problem. The Examiner, after noting that in a drilling fluid gelatinized starch tends to ferment where there is no high concentration of salt, says, Def. Ex. F, App. 204, 208:

> "* * * Applicants have found that fermentation can be prevented and a drilling mud made and maintained in an advantageous condition by rendering the mud highly alkaline and keeping it in that state, when starch is used. The resulting mud, which may or may not contain clay in addition to the starch and alkali, has a very low water loss, a suitable viscosity for drilling and is immune from deterioration due to fermentation. The water loss refers to the wall-sealing properties of the mud, that is, its ability to plaster the walls of the borehole so as to prevent the (sic) any large amount of water from the mud from passing out into the formations being drilled. Low water loss is a very desirable property of a drilling mud. The viscosity should be low enough to allow easy pumping of the mud and quick settling of cuttings after the mud leaves the well, but high enough to keep the cuttings suspended until the mud can carry them out of the well. Applicants use enough alkali to keep the pH of the mud at about 12 and enough starch to give a water loss of less than 5 c. c's preferably and to keep the viscosity between desirable operating limits. * * *"*

That and no more is what applicants claim here; viz., in the broadest claim 3, App. 212:

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* The Board of Appeals decision is to the same effect, Pl. Ex. H, App. 215, etc., conceding that there is a peculiar problem in this art.

> "Claim 3. In the art of drilling wells by the employment of an aqueous mud-laden drilling fluid, the process comprising, adding to such a fluid, while maintained at a pH of about 12, sufficient of a starchy colloid to attain and maintain a substantial wall-seal of low water loss, viz., below 5 c. c. (A. P. I.) and at an operable well-drilling viscosity."

The Examiner concedes as to the Cannon patent and the Stern Report, Def. Ex. F, App. 204, 209:

> "The Examiner does not contend that these references teach the basic principle of applicants' discovery * * *."

By avoidance, the Examiner then says:

> "* * * but they do show the use in drilling muds of the same materials and in the same proportions as these are set forth in the claims. It is immaterial that the materials are added for a different purpose or that the patentee and the author did not appreciate all the advantages that resulted from the use of these compositions."

The first part is not a fact, as we have shown, while the second part is of importance in a process as will appear.

The Patent Office concedes, and the District Court found, Finding 10, App. 7:

> "10. The Plaintiff's testimony shows commercial success of the process of the claims in suit."

The prime question here really resolves itself into the simple one of whether the Stern Report and the Cannon patent, **disclosed to those skilled in this art** the procedural steps set forth in the claims and supported by the specification of the application in suit, regardless even of purpose and result, although both are of moment where a process is involved, particularly one based on a discovery.

The invention here is based upon a discovery, that when a mud-laden drilling fluid is maintained at a high alkalinity, specified in the claims as "at a pH of about 12", then a water seal of low water loss, specified as "below 5 c. c.", can be maintained by the addition of gelatinized or hydrolyzed starch, specified in the claims as a "starchy colloid", but at an operable well-drilling viscosity.

That the above was "applicants' discovery" was conceded by the Examiner in the parts just quoted, who specifically conceded that the drilling fluid or mud so treated

> "has a very low water-loss, a suitable viscosity * * * and is immune from deterioration due to fermentation."

The Aspects of an Art or Process.

We want to cite and quote from a few fundamental decisions.

Corning v. Burden, 15 How. (56 U. S.) 252, discusses the fundamental attributes of a process as follows, 267-268:

> "A process, eo nomine, is not made the subject of a patent in our act of Congress. It is included under the general term 'useful art.' * * * But where the result or effect is produced by chemical action, by the operation or application of some element or power of nature, or of one substance to another, such modes, methods, or operations, are called processes. A new process is usually the result of discovery; a machine, of invention. * * * It is for the discovery or invention of some practicable method or means of producing a beneficial result or effect, that a patent is granted, and not for the result or effect itself. It is when the term process is used to represent the means or method of producing a result that it is patentable. * * *"

That case has been consistently followed by the Supreme Court and by this Court; thus in **Kelley v. Coe,** 69 App. D. C. 202, 99 Fed. 2d 435, this Court said, 441 footnote:

> "A process is a mode, method, or operation, whereby a result or effect is produced. Corning v. Burden, 15

> How. 252, 14 L. Ed. 683. 'A patentable process is a method of treatment of certain materials to produce a particular result or product.' Holland Furniture Co. v. Perkins Glue Co., 277 U. S. 245, 255, 48 S. Ct. 474, 478, 72 L. Ed. 868."

From the above, it will be seen that a patentable process is not only characterized by the mode, method or operation, i. e., the procedure, but also by **the effect or result produced.** Of course, the result or effect per se is not patentable, but what is patentable is the "method or means of producing a beneficial result or effect" or "whereby a result or effect is produced"; Corning v. Burden, and Kelley v. Coe, supra. That mode, method or operation is expressed in the claims in suit and that produces the result or effect of rendering the drilling fluid "immune from deterioration due to fermentation" as conceded by the Examiner, see page 34, supra. That result or effect need not therefore be set out in the claims. That follows from the fundamental proposition of patent law, as stated by this Court in **Smith v. Kingsland,** 85 U. S. App. D. C. 284, 178 Fed. 2d 26, 28:

> "It is also true that claims must be read in the light of the specification, not to enlarge them, but to ascertain their meaning and the intention of the patentee with respect to them. * * *"

A process based upon a discovery has a preferred standing, and naturally so, because in such a case the subject-matter is not simply one of detail improvements but is one involving new applications of the laws of physics and chemistry. That was forecast in Corning v. Burden when the Supreme Court says, 15 How. 252, 267:

> "A new process is usually the result of discovery; a machine, of invention."

Tilghman v. Proctor, 102 U. S. 707, 721, involved a process of making glycerine from fat, based upon the following:

> "He discovered that fat can be dissolved into its constituent elements by the use of water alone under a high degree of heat and pressure; * * *."

Fermentation Co. v. Maus, 122 U. S. 413, 423, involved a process of preparing and preserving beer for the market by holding it under controllable pressure of carbonic acid from the beginning of the kraeusen stage until such time as it is transferred to kegs and bunged. As to that process, the Supreme Court said, p. 428:

> "* * * There appears also to be a new principle of action involved in the invention of the patentees."

The Mathiesen Works v. Coe, 69 App. D. C. 210, 99 Fed. 2d 443, involved a process of bleaching cellulosic materials by a solution of a chlorite as distinguished from a hypochlorite, which former this Court found was a "discovery made by the applicants", p. 447.

United Chromium v. International Silver Co., 53 Fed. 2d 390, affirmed 60 Fed. 2d 913, C. C. A. 2, certiorari denied, 288 U. S. 600, involved a process of chromium plating, based upon the following:

> "* * * The patentee discovered that for commercial plating the fundamental and essential thing was to regulate the concentration of the catalyst acid radical (SO_4) at the start, and always, so as to secure and maintain the ratio of the chromic acid and catalyst acid radical $\frac{CrO_3}{SO_4}$ within definite limits and preferably at $\frac{100}{1}$. * * *"

Gasoline Products Co. v. Coe, 66 App. D. C. 333, 87 Fed. 2d 550, C. C. A., D. C., involved the employment of a chromium alloy as a resistant to sulphur corrosion. The Court, ordering issue of the patent, says, p. 556:

> "Discovery of a source of trouble not before known and the discovery and application of a remedy are well recognized as invention. Eibel Process Co. v. Paper Co., 261 U. S. 45, 43 S. Ct. 322, 67 L. Ed. 523."

While here possibly Applicants did not discover what caused fermentation, although they did observe that it was the bacteria, yeasts, molds, and **particularly enzymes** derived therefrom which break down the gelatinized starch into dextrose and sugar, and which could not be killed by preservatives; Pl. Ex. 1, App. 133, 139. They did however discover the remedy which is **effective in all cases**, whether the drilling fluid is fresh water or salt water, or whether it becomes contaminated with cement or gypsum. The prior practice was limited to those cases where drilling was through or with salt, which was corrosive to the steel drilling equipment.

We have stressed the fact that applicants' process is based on a discovery. This case is, therefore, entirely different from those cases which have been considered by this Court and by the Supreme Court involving detail improvements, or the result of ordinary research with manipulations well within the skill of the calling. Such is not the case here.

It was unknown that gelatinized starch could be kept immune from deterioration in such a complex thing as a well drilling fluid, subject to contamination by yeasts and particularly by enzymes, by maintaining the fluid at a high alkalinity, but not too low and not too high, i. e., between, a pH of 11.7 and 13.2, expressed in the claims as "about 12". **That was a scientific discovery** made by the applicants, and the Patent Office has produced no writing or any testimony of anyone skilled in the art to dispute that; for even the Examiner admits, Def. Ex. F, App. 204, 209:

> "The Examiner does not contend that these references teach the basic principle of applicant's discovery * * *."

Based on that scientific discovery, applicants invented their process comprising, as stated in the broadest claim 3, App. 212:

> "* * * adding to such a fluid, while maintained at a pH of about 12, sufficient of a starchy colloid to attain and maintain a substantial wall-seal of low water loss, viz., below 5 c. c. (A. P. I.), and at an operable well-drilling viscosity."

Such a process is patentable under the law; for the Patent Office has found no prior art of that process any more than of applicant's fundamental discovery.

The Stern Bulletin Does Not Disclose Applicant's Invention.

We have shown pp. 15-17, supra, that all that Stern discloses is making of gelatinized starch suspension by the usual **10 to 1** ratio of caustic soda and raw starch in accordance with the practice from 1888 on to the very month of the Stern Report. The pH of about 11 or 12 was obviously that of the gelatinized starch suspension and not of the drilling fluid to which it was to be added.

This is not a case involving the testimony of witnesses seeking to contradict what is said in a publication; that testimony shows what one skilled in this art gathered from the Stern Report; and such testimony is admissible as appears from the authorities p. 43, infra. Furthermore, we have here extraneous evidence supporting the witnesses, namely; the usual method of gelatinizing starch from 1888 on, applied by Gray et al., in their paper the same month as the Stern Report, described in the Chapman patent filed about the same time and even described by Stern in his Report.

Is it possible that Stern in 1941 disclosed to the art preventing fermentation by and maintaining a drilling fluid at a pH of 12, when he describes for that purpose the use of equipment-corroding salt and even alcohol? Would the art have continued for over two years with limiting the use of gelatinized starch to areas where salt domes were drilled through in the course of drilling for oil? This is a fast moving art and was so during the war which was in a critical stage in 1943, when our Government was so impressed that it permitted Plaintiff to sell gelatinized starch, a food product, by the train load. This is surely a case where the Patent Office should not be affirmed in refusing a patent for an exceedingly important process **based on a scientific discovery**, by the general sentence, at the end of the description for gelatinizing starch by a 10 to 1 ratio, D-201, 203:

> "A pH of about 11 or 12 has been found desirable."

As Farnham testified, App. 46, Tr. 68:

> "Q. Suppose you boil it, instead of it being in the cold, what is it then? A. Starch will gelatinize at a lower pH if it is boiled.
>
> Q. Will it gelatinize at 11 if it boils? A. Yes."

Note that Stern describes "boiling" the starch and caustic.

But following the Stern Report if the sentence applies to the pH of the drilling fluid, a pH of 11 will not prevent fermentation, for the pH must be at least 11.7,* Pl. Ex. 1, App. 133; Farnham, App. 43, Tr. 68; accordingly one following the Stern Report would go astray. Applicants have been very specific as to both the lower and upper limits of the pH, Pl. Ex. 1, App. 133, 139. The Stern Report does not comply with the requirements of a publication to warrant refusal of a patent as shown p. 44, infra.

The Cannon Patent Does Not Disclose Applicant's Invention.

The facts as to the Cannon patent were summarized, p. 15, supra, and elaborated upon, p. 21, etc., supra.

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* Note again that the difference between 11 and 11.7 is on a logarithmic scale, which means that at 11.7 the fluid is many times as alkaline as at 11; pp. 9, 21, supra.

The Cannon patent is one of a type of patents condemned by the Courts. It attempts to monopolize a whole field of agents under the broad term, "an organic compound containing three or more hydroxyl groups," Def. Ex. A, App. 193, patent page 1, right, lines 34-37. Cannon lists 18 tannin extracts, page 2, left, but he gives as an example only one, namely: quebracho extract, a crude tannic acid, page 2, right. Cannon lists also starch, page 1, left, line 4 (but not gelatinized starch), with no example of a drilling fluid containing starch, showing the results obtained by using it.

The Cannon patent must, of course, be read in its **environment** and it was so read by those skilled in the art. That environment shows that the Cannon patent, employs caustic soda with tannic acid as usual **to thin** a drilling fluid; that is shown by the Lawton et al. patent and was confirmed by Farnum, Larsen and Beesley.

Whether starch (ungelatinized) which is inert, will thin a drilling fluid, is not of moment, because we are dealing here with **gelatinized starch** (starchy colloid) which is **a thickener** like bentonite, and that was confirmed by Farnum, Larsen and Beesley. That is also confirmed by Gray et al. as shown by Farnum. None of that was disputed by defendant's counsel at the trial, who did not even cross-examine Farnum on that phase at the trial.

From the above it will be apparent that if it be attempted to substitute starch for a tannin acid in the Cannon patent, as the Patent Office attempts to do, the result will be **exactly the opposite** from what Cannon sought to attain, namely, the thinning of a thick drilling fluid made up of a thickener, namely, bentonite, and would defeat the very object that Cannon sought to attain. Surely:

> A thickener + a thickener = a greater thickener, not a less thickener, i. e., a thinner fluid.

The position of the Patent Office is about as unsound as was the old idea that an anemic person could be cured by bleeding.

Here again we do not simply have the testimony of witnesses, although highly skilled in this art, supported by experiments in and out of Court, **none of which were refuted**, but we again have publications before and after the issue of the Cannon patent.

The Chapman patent issued in 1946, to the assignee of the Cannon patent, refers to what Cannon disclosed as something to overcome the "undesirable consistency", App. 189, page 1, right, line 15. Further that if starch be employed in the proportion suggested by the Examiner, namely 2%, p. 2, left, line 10:

> "it not only doesn't retard loss of water by filtration, but actually has an adverse effect."

The District Court disregarded all that evidence, in spite of the fact that if it were attempted to substitute starch for a tannic acid in the Cannon patent, and in all of the examples given, the drilling fluid would be so thick as to be wholly **unusable.** The claims in suit carefully specify that with the drilling fluid maintained with a substantial water seal of low water loss, viz., below 5 cc., the fluid will be:

> "at an operable well drilling viscosity."

The Examiner admitted that, Def. Ex. F, App. 204, 209.

Surely the Patent Office should not be affirmed in its unreasonable distortion of the Cannon patent to make out applicants' invention based on a discovery, when by doing so a wholly **unusable** thing is secured and when that would **defeat** the very objects and purposes of the Cannon patent.

Application of Further Authorities.

A patent like a publication is addressed to one skilled in the art to which the subject-matter relates; indeed, the situation is analogous to the sufficiency of the specification of a patent in an infringement suit, and as to the sufficiency thereof R. S. 4888, 35 U. S. C. 33, has a criterion, namely, "any person **skilled in the art or science** to which it appertains. . . ." That view was confirmed by the Supreme Court in Carnegie Steel Co. v. Cambria Iron Co., 185 U. S. 403, 437:

> ". . . The specification of the patent is not addressed to lawyers, or even to the public generally, but to the manufacturers of steel, and any description which is sufficient to apprise them in the language of the art of the definite feature of the invention, and to serve as a warning to others of what the patent claims as a monopoly, is sufficiently definite to sustain the patent. He may assume that what was already known in the art of manufacturing steel was known to them, . . ."

It accordingly follows that the testimony of Farnham and Larsen both highly skilled in this art was proper to show **the environment** leading to the Stern Report and what was meant by the language of that Report, i. e., **preparation** of gelatinized starch by a **10-1 ratio** of caustic to starch used since 1888 and later used in the oil fields. So also was the testimony as to the environment of the Cannon patent by showing in what way caustic and a tannin had been used to thin and not to thicken a drilling fluid and that gelatinized starch thickened the drilling fluid.

In **Radtke Patents Corp. v. Coe,** 74 App. D. C. 251, 122 F. 2 937, 946, this Court remanded the case to the District Court for the purpose of receiving testimony of one skilled in the art as to the knowledge of one skilled in the art as to what was contained in a prior scientific publication relied upon by the Patent Office. This Court did likewise in **International Corp. v. Kingsland,** 81 App. D. C. 215, 169 F. 2 890.

Robinson on Patents sets out the requirements of the prior patent or publication as follows:

> "The invention described in the publication must be identical in all respects with that whose novelty it

> contradicts. The same idea of means, in the same stage of development, as that which the inventor of the later has embodied, must be thereby communicated to the public. The invention thus described must also have been a complete and operative art or instrument, ready for immediate employment by the public. And it must be described, not as a mere hypothesis either in method or in possibility, but as an existing fact already known." Vol. I, p. 450.

That view is supported by the decisions of this Court, as will appear.

Kelley v. Coe, 69 App. D. C. 202, 99 F. 2 435, involved p. 441 a procedure in rock drilling, involving maintaining a negative or sub-atmospheric pressure in the hood at all times during operation; and the prior art did not recognize the necessity for permitting free entry of air under conditions of sub-atmospheric pressure in the hood. Kelley himself had first worked on the theory of the prior art and failed. This Court said:

> ". . . And it was not until the theory of operation described in Kelley's method was understood by those who had failed in their efforts to use the Prellwitz method in the light of the prior art, that they realized the fundamental defect of the Prellwitz method and the reason for its failure. In order that a reference or group of references may teach a process, the process must be deliberate and the means understood." p. 441.

That applies directly to the Stern Report who described a procedure of using a concentrated salt drilling fluid or alcohol to avoid fermentation; it did not describe the maintenance of the drilling fluid at a pH of about 12, which is universal in its application.

Lucke v. Coe, 63 App. D. C. 61, 69 F. 2 379, shows the view of this Court in patent cases when it says, p. 383:

> ". . . It is comparatively easy, now that the Lucke device is in evidence, to take this and that from the references and achieve a nunc pro tunc solution of the problems confronting Lucke when he made his invention. We rule, therefore, that the claims denied by the Patent Office should be allowed."

In **Seyfarth v. Coe,** 76 U. S. App. D. C. 96, 129 F. 2 58, the prior art failed to teach the step essential to attain the desired results, which in this case is the maintenance of the drilling fluid at a high alkalinity of about 12 pH, particularly where sufficient starch is added to secure a water loss of below 5 c. c. and all at an operative drilling viscosity.

Otto v. Robertson, 62 App. D. C. 233, 66 F. (2d) 213, involved a situation where it was attempted to reconstruct a prior art patent in order to meet the application in suit; this Court says:

> ". . . 'It is not sufficient to constitute an anticipation that the device relied upon might, by modification, be made to accomplish the function performed by the patent in question, if it were not designed by its maker, nor adapted, nor actually used, for the performance of such functions.' "

The Mathieson Alkali Works v. Coe, 69 App. D. C. 210, 99 F. 2 443, involved a process of bleaching cellulosic materials with an acid solution containing a chlorite of a metal. In the prior art hypochlorites had been employed, and the Patent Office took the position that they acted the same way. The Court, in holding that the patent should issue, says, p. 444:

> ". . . The reference discloses nothing concerning the bleaching of cellulosic materials, and discloses nothing concerning the different reactions of chlorites and hypochlorites in an acid solution . . ."

That applies to the Cannon patent which did not disclose what would happen if starch were substituted for tannic acid, but was directly contrary to what happened when tannic acid was used, because the drilling fluid was thickened rather than thinned.

Becket v. Coe, 69 App. D. C. 53, 98 F. 2 332, involved "a stain-resisting iron-base alloy having deep drawing properties." p. 333. It was an iron-base alloy containing in addition to iron, chromium, manganese, nickel and copper. There, as here, prior patents were relied upon which **did not have as their object** the production of a stain-resisting alloy having deep drawing properties, and some of the patents contained **general statements** which were relied upon by the Patent Office as disclosing Becket's invention. The following language of the Court is particularly pertinent here:

> ". . . A careful reading of the patent, however, convinces us that so far as a chromium-manganese-nickel-copper ferrous alloy is concerned the inventor was but guessing in the dark. This type alloy is mentioned only as a variant of a chromium-nickel-manganese alloy, with neither details as to what different results would be obtained, nor any indication that the metal would resist staining." p. 335.
>
> ". . . With the Becket application before us it is possible to look back upon the Hadfield (French) and Commentry (French) patents and to say that they suggested what he found, but such hindsight should not, we think, defeat his application. Hadfield and Commentry seem neither to have sought nor to have found an alloy which is both stainless and deep-drawing, and though it be true that the scope of their ranges embraces the claims of Becket, this speaks of the extent of their desire rather than of the breadth of their discoveries." p. 336.
>
> ". . . One seeking a stainless deep-drawing alloy and finding the Hadfield (French) and Commentry (French) patents could not have said: 'These give me what I want.'" p. 336.

Certainly Cannon seeking to reduce the viscosity of drilling fluid by caustic-tannin solution could not **by mere enumeration** of starch disclose the very opposite. To a like effect is Toch v. Zibell Damp Resisting Paint Co., 231 F. 711, 714, C. C. A. 2, where the patent enumerated 17 substances, with examples of only 2 or 3.

In Re Tone, 154 F. 2 179, C. C. P. A., involved a case where the attempted modification of a prior patent by the Patent Office **defeated** the very object of that prior patent and therefore was held not a statutory bar.

It is, of course, well settled that a prior art reference **incapable of use** as contemplated by an application for a patent asked for or by an issued patent, can be no statutory bar. Moffett v. Fiske, 60 App. D. C. 281, 51 F. 2 868; Hoover v. Eckerd's Co., 53 F. 2 215, Del.; In Re Gillam, 37 F. 2 959, C. C. P. A.; Siemund v. Enderlin, 212 F. 410, C. C. A. 2.

It is, of course, well settled that in order for two things to be **equivalent** they must be **capable** of operating in substantially the same way to secure substantially the same results. That is certainly not true of starch and tannic acid, one of which is the **very antithesis** of the other. The mere fact that they may belong to the same chemical class is not determinative; Corona Tire Co. v. Dovan Chemical Corp., 276 U. S. 358; Ward Baking Co. v. Hazelton Baking Co., 292 F. 202, 205, D. C. Pa. That is particularly true when one is used for another purpose than is the other. In re Lowry, 93 F. 2 909, C. C. P. A. As was said in Cardinell Corp. v. Scriptex Ink Co., 21 F. Supp. 60, D. C. Pa.:

> "No range of equivalence will include a substance which, though it may produce a given result, lacks the quality necessary to practical usefulness."

That is, of course, for the reason that equivalency is determined by functional action. Treibacher Werke v. Roessler Co., 219 F. 210, C. C. A. 2.

DISTRICT COURT'S MEMORANDUM AND FINDINGS.

We fully appreciate the burden on a plaintiff in a suit under R. S. 4915, and the effects to be given to the Findings of a District Court. We, however, want to note the following:

The Informal Memorandum, App. 6, of the District Court is brief and not illuminating. After that Defendant presented Findings of Fact, App. 6, which were entered. Plaintiff presented Proposed Findings, App. 8, which were fully in accordance with the evidence, filed the day after Defendant's Proposed Findings were entered, but Plaintiff's Proposed Findings were not entered under Civil Rule 52 (b). Plaintiff then filed its Motion for a New Trial, App. 12, based on Plaintiff's Proposed Findings, but that motion was overruled, App. 22, without an opinion.

We submit that Plaintiff has sustained the burden imposed on it. The evidence is by more than a mere preponderance and is clear, satisfactory and practically conclusive. There is no rational basis for the conclusions of the Patent Office or of the District Court. The Findings of the District Court have no basis in the evidence but are contrary to the evidence and the conclusions are contrary to the settled law of this Court and of the Supreme Court. Where, as here, the facts are proved, the question of validity is one of law, A. & P. Co. v. Supermarket Corp., 340 U. S. 147, 156.

It would certainly result in a miscarriage of justice if the Patent Office and the District Court be affirmed in this case. To say that the Patent Office can stand practically mute at the trial without controverting the testimony of four highly skilled in this art witnesses, supported by scientific publications, on the technical questions involved, showing that the Patent Office was in error on those questions, and still affirm the Patent Office, goes contrary to what courts have done since the establishment of our

Judicial System. To withhold from Plaintiff a patent on a highly useful process based on a discovery, and so conceded by the Patent Office, on prior art which is so far afield as here, will discourage invention.

The claims asked for are exceedingly modest and are consonant with the discovery of the applicants. They do not cover all methods of employing gelatinized starch in drilling fluids, but only a narrow but important niche in that art. As shown, page 3, supra, Plaintiff's policy is not to monopolize but offers licenses without restrictions.

The Patent Office has seen fit to grant to a subsidiary of Standard Oil of New Jersey, the Chapman Patent No. 2,399,986, App. 189, covering another niche for the employment of gelatinized starch in salt water drilling fluids. As this Court said in Poulsen v. Coe, 73 App. D. C. 324, 119 F. (2) 188, 199:

> "While the rule of stare decisis does not apply to decisions of the Patent Office, there is a presumption of correctness in such decisions, and if what the appellants did is at least as inventive in quality as what Robinson and Hewlett did, the granting of a patent to the latter should be persuasive in respect of the right to a patent by the former."

It is therefore respectfully submitted that the District Court should be reversed.

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St. Louis, Missouri,
February 23, 1951.

BRIEF FOR APPELLEE

United States Court of Appeals
FOR THE DISTRICT OF COLUMBIA CIRCUIT

United States Court of Appeals
for the District of Columbia Circuit
FILED MAR 20 1951
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Appeal No. 10873

NATIONAL LEAD COMPANY, A CORPORATION, APPELLANT

v.

JOHN A. MARZALL, COMMISSIONER OF PATENTS,
APPELLEE

APPEAL FROM THE JUDGMENT OF THE UNITED STATES DISTRICT COURT FOR THE DISTRICT OF COLUMBIA

E. L. REYNOLDS,
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Attorney for Appellee.

H. S. MILLER,
Of Counsel.

STATEMENT OF QUESTION PRESENTED

In the opinion of appellee, the question is whether the District Court was right in refusing the process claims at bar of the application for patent owned by appellant, which claims relate to the use of a well drilling fluid containing a starchy colloid which is maintained at a pH value of about 12, as being unpatentable in the application in view of the teachings of the patent to Cannon and the Stern Report, each disclosing the use of caustic soda in connection with starch used in a well drilling fluid, and the further teaching of The Solvay Blue Book that a 1% solution of caustic soda has a pH value just under 13.

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United States Court of Appeals

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APPEAL FROM THE JUDGMENT OF THE UNITED STATES DISTRICT COURT FOR THE DISTRICT OF COLUMBIA

BRIEF FOR THE COMMISSIONER OF PATENTS

COUNTERSTATEMENT OF THE CASE

While an accurate statement of the case can be gathered from pages 2 to 31 of appellant's brief, these pages include so much argumentative matter that it is believed a more concise statement of the case is that the issue here presented is whether the District Court was right in refusing to allow the process claims at bar of the application for a patent, which application is owned by appellant by assignment from the applicants. The answer to this question depends, in turn, upon the answer to the question hereinbefore set forth under the heading "Statement of Question Presented."

SUMMARY OF ARGUMENT

1. There is no patentability in using a well drilling fluid containing gelatinized, hydrolyzed or colloidal starch.

2. There is no patentability, when using a well drilling fluid of the character just specified, in maintaining the alkalinity thereof at a pH value of about 12, in view of the patent to Cannon (Joint Appendix 193), the publication by Stern (Joint Appendix 201) and The Solvay Blue Book (Joint Appendix 199).

3. The fact that the applicants who filed the application owned by appellant discovered that gelatinized starch in a well drilling fluid could be kept immune from deterioration by maintaining the fluid at an alkalinity having a pH value of about 12, is not such a discovery as warrants granting a patent, where the facts are set forth in the preceding paragraph.

4. Contrary to the allegation of appellant's statement of points numbered (1) at page 32 of appellant's brief, it is submitted that the testimony adduced at the trial shows no error on the part of either the Patent Office or the District Court in refusing the claims at bar, but rather shows that such refusal was correct.

ARGUMENT

The appellant, as owner by assignment of the application for patent of Dee A. Sykes and Jack H. Beesley, Serial No. 489,890 (Joint Appendix 133) sought, as plaintiff in an action under 35 U. S. C. 63, a decree from the District Court authorizing the allowance of the process claims of said application at bar. These claims are not treated individually in appellant's brief, and they will not be individually treated here, as it is believed they stand or fall together.

The application owned by appellant claims as an improvement over the acknowledged prior art of using a well drilling fluid containing gelatinized, hydrolyzed or colloidal starch, the maintenance of the alkalinity of such fluid at a pH of about 12 (Joint Appendix 138). This is done by the addition of any suitable alkali, such as caustic soda (Joint Appendix 139, second paragraph) to bring the drilling fluid to the desired pH value. Although the claims at bar specify a value for the pH of about 12, it is clear from the application disclosure itself that there is nothing critical about the precise value of 12.

The specification of the application at bar clearly brings out (Joint Appendix 139, first paragraph) that "a pH of 11.7 is in many cases sufficient. * * * We have, however, found that generally the pH should not be above 13.3, because * * * ." Thus it appears that the expression in the claims of "about 12" is intended to allow some leeway, and, on the basis of the specification, is intended to mean anything from 11.7 to 13.3.

1. The application of appellant acknowledges as prior art the use of colloid materials such as starch in a well drilling fluid. (Joint Appendix 134). By the testimony before the District Court, gelatinized starch, hydrolized starch, colloidal starch and pasted starch are all the same thing. (Joint Appendix 71, last four lines).

The patent to Cannon (Joint Appendix 193) relates to a drilling fluid. The District Court found (Finding of Fact 3, Joint Appendix 7) that the patent discloses, inter alia, a drilling fluid including starch and caustic soda, various values being mentioned for the caustic soda, one value of which is 1%. The District Court further found that a 1% solution of caustic soda will gelatinize or hydrolize starch. (Finding of Fact 7, Joint Appendix 7). The last mentioned finding of fact is clearly supported by the evidence. (Joint Appendix 73, last three lines down to 74, first two lines).

The publication by Stern (Joint Appendix 203) refers to the use of hydrolyzed starch in a well drilling fluid. The District Court so found as a finding of fact numbered 4 (Joint Appendix 7).

From the foregoing it is submitted to be abundantly clear that there was no patentability in the use of a well drilling fluid containing gelatinized, hydrolyzed or colloidal starch.

2. It next remains to discuss whether patentability might reside in making a well drilling fluid of the character just discussed alkaline, to the pH value of about 12. For the reasons already hereinbefore explained, the specification of the application at bar itself shows that the pH value may vary anywhere from 11.7 to 13.3.

It has hereinbefore been explained wherein the patent to Cannon (Joint Appendix 193) discloses a drilling fluid including starch and caustic soda, the caustic soda being present in various amounts, one amount being 1%. It has also been shown that where caustic soda is present in the amount 1% it will gelatinize or hydrolyze starch. It is true that the patent to Cannon does not state what is the pH value of the drilling fluid containing 1% of caustic soda. However, The Solvay Blue Book (Joint Appendix 199) discloses what is the pH value of a solution containing 1% of caustic soda. The District Court found as a fact (Finding of Fact 6, Joint Appendix 7) that the Solvay Blue Book discloses that the pH value of a 1% solution of caustic soda is just under 13.0.

It is therefore submitted that the evidence is ample to support Finding of Fact 8 of the District Court (Joint Appendix 7) that "The claims at bar define no invention over the disclosure of the patent to Cannon."

It has already hereinbefore been explained wherein the publication by Stern discloses the use of hydrolyzed starch in a well drilling fluid. (Joint Appendix 203, lines one to three.) The publication then goes on (lines 6 and 7, same page) to state that "A pH of about 11 or 12 has been found desirable."

Although appellant argues at page 17 of its brief that the pH referred to by Stern is the pH of the starch-caustic mix, and not that of the drilling fluid to which it is then added, nevertheless the District Court found in Finding of Fact 4 (Joint Appendix 7) that the pH of about 11 or 12 that has been found desirable "refers to the pH value of the drilling fluid." It is submitted that this conclusion was reasonable in view of all the evidence before the District Court.

It is therefore submitted that the District Court rightly found, in Finding of Fact 9 (Joint Appendix 7) that "the claims at bar define no invention over the disclosure of the publication by Stern."

It is further submitted, in view of the discussion of the patent to Cannon and the publication by Stern, that there is no patentability, when using a well drilling fluid containing gelatinized, hydrolyzed or colloidal starch, to maintain the alkalinity thereof, by the use of caustic soda, at a pH value of about 12.

3. It is said at page 39 of appellant's brief that—

> It was unknown that gelatinized starch could be kept immune from deterioration in such a complex thing as a well drilling fluid, * * * by maintaining the fluid at a high alkalinity * * * between a pH of 11.7 and 13.2, expressed in the claims as "about 12." That was a scientific discovery made by the applicants * * *.

Assuming that applicants made the scientific discovery referred to by appellant, it does not follow that a patent may be granted merely on the basis of that discovery. For the reasons stated in developing point 2 under summary of argument hereinbefore presented, it is submitted to be clear that there was no patentability in the hydrolyzed starch containing well drilling fluid of pH value of about 12. The discovery of the fact that such unpatentable use of the pH value of 12 would keep the gelatinized starch immune from deterioration is merely the discovery of a hitherto unstated property of an unpatentable well drilling fluid.

The District Court found as Conclusion of Law 1 (Joint Appendix 8) that "The discovery of a hitherto unstated property of a well drilling fluid containing starchy colloid and sufficient caustic soda to make the pH value about 12 is not such a discovery as entitles plaintiff to a patent therefor."

The conclusion of the District Court in this respect is submitted to be amply supported by the case of *In re Jones,* 28 CCPA 1302, 120 F. 2d 1019, cited by the Board of Appeals (Joint Appendix 221) and the cases therein cited (Joint Appendix 221, 222).

Stated differently, on the prior art presented, the public should be entitled to use, on the expiration of the Cannon patent, everything taught therein, with all of the results flowing therefrom, whether the results be stated by the prior art or not. *Roberts* v. *Ryer,* 91 U. S. 150. The mere fact that appellant's assignors, the applicants in the application in suit, discovered that a pH value of about 12 prevents the fermentation of the starch, is not sufficient, it is submitted, to warrant granting appellant the here-sought monopoly, which would require the public, when using the prior art combination of drilling fluid containing gelatinized starch and caustic soda, to keep away from using that amount of caustic soda which will bring the pH value to "about 12."

4. It is alleged at page 32 of appellant's brief that the testimony adduced at the trial shows clear error on the part of the Patent Office in refusing a patent. It is further alleged at page 49 of appellant's brief that there is no rational basis for the conclusions of the Patent Office or of the District Court, and that the Findings of the District Court have no basis in the evidence and the conclusions are contrary to the settled law of this Court.

However, it is submitted that the detailed discussion of the evidence, which includes the prior art, as hereinbefore presented does show a rational basis for the conclusions of both the Patent Office and of the District Court.

It is further submitted that the testimony adduced at the trial shows no error on the part of either the Patent Office or the District Court in refusing the claims at bar, but rather shows that such refusal was correct.

Where such is the case, a reasonable finding of the Patent Office and the District Court should not be set aside. *Besser* v. *Ooms,* 81 U. S. App. D. C. 7, 154 F. 2d 17, and authorities therein cited under footnote 3, including *Abbott et al.* v. *Coe,* 71 App. D. C. 195, 109 F. 2d 449, cited (Joint Appendix 6) in the informal memorandum of the District Court.

CONCLUSION

It is therefore submitted that the claims at bar fail to define invention over the prior art, that the District Court was right in upholding the ruling of the Patent Office to that effect, and that accordingly the judgment from which appeal has been taken should be affirmed.

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H. S. MILLER,
Of Counsel.

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No. 10,873.
APPELLANT'S REPLY BRIEF.

UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT.

NATIONAL LEAD COMPANY, a Corporation,
Appellant,

vs.

JOHN A. MARZALL, Commissioner of Patents,
Appellee.

Appeal from the United States District Court for the
District of Columbia.

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SUMMARY OF REPLY TO APPELLEE'S BRIEF.

Appellee

[redacted]'s Brief confuses the issues before this Court.

(1) Appellee's Counsel continuously understate and even side step what is claimed in the process claims in suit, which accurately state the metes and bounds of applicants' process.

(2) Counsel distort the Stern description by reading into it something not disclosed therein, viz.: by asserting that the pH mentioned by Stern is that of the drilling fluid, although what Stern specifies is the pH of a caustic-soda-water suspension of a raw starch in order to produce a gelatinized starch suspension, which is later added to the drilling fluid and diluted thereby much below a pH of 12.

(3) Counsel likewise distort the Cannon description by reading into it something not disclosed therein, viz.: by asserting that what is mentioned in the Cannon patent is gelatinized starch and not "starch," an inert thing, which the patent specifically mentions.

(4) Counsel disregard the environment with reference to the Stern and Cannon disclosures, which taught the art that Stern simply disclosed the gelatinization of starch in a caustic-water-solution, and that Cannon simply taught the art to use the agents described by Cannon to thin rather than thicken a drilling fluid.

(5) Counsel assert that there is nothing critical in the pH of a drilling fluid employing gelatinized starch, although the evidence shows that when the pH is too low fermentation will not be inhibited, but when too high the starch will become caramelized and sugar-like.

(6) Counsel disregard the wide limits in the proportions of caustic in the Cannon disclosure which, although if followed with respect to quabracho (tannin), will produce a satisfactory thinner as contemplated by Cannon, but if followed with respect to starch, at the lower limit, will not produce gelatinized starch and at the higher limit will caramelize starch.

(7) Counsel disregard the fact that if starch be substituted for quabracho in Cannon's process, Cannon's very object

of thinning a drilling fluid will be defeated and the drilling fluid will become inoperable.

(8) Counsel assign to Finding 3 something which is contrary to the Finding itself, because that Finding specifies "starch" and not "a starchy colloid," i. e., gelatinized starch as specified in the claims.

(9) Counsel insists on Finding 4 (proposed by Appellee's Counsel) to the effect that Stern "refers to the pH value of the drilling fluid," although that is contrary to the evidence.

(10) Counsel seek to combine the Stern and Cannon disclosures although the result will not and cannot be applicants' invention.

(11) Finally, Counsel entirely ignore the challenges in Appellants' Brief as to the facts and the law, and particularly our challenges that determinative testimony was not disputed, and that the decisions of this Court and of the Supreme Court, cited in Appellants' Brief, were ignored by Appellee's Counsel.

In view of the above, it will be necessary for Appellants' Counsel to extend this Brief somewhat more than would ordinarily be necessary, and to quote from testimony for the convenience of the Court, because Appellees' Counsel have either disregarded the testimony or only referred to parts, disregarding what the witnesses actually said.

APPELLEE'S STATEMENT OF QUESTIONS PRESENTED.

Because of the understatement of what is specified in the claims in suit, we will first again quote the broadest claim 3, App. 212, which is as follows:

> "Claim 3. In the art of drilling wells by the employment of an aqueous mud-laden drilling fluid, the process comprising, adding to such a fluid, while maintained at a pH of about 12, sufficient of a starchy colloid to attain and maintain a substantial wall-seal of low water loss, viz., below 5 cc (A. P. I.) and at an operable well-drilling viscosity."

The claims do not simply

> "relate to the use of a well-drilling fluid containing a starchy colloid which is maintained at a pH value of about 12."

Nor do the claims simply specify:

> "the use of caustic soda in connection with starch used in a well-drilling fluid."

The first is asserted by Appellee's counsel for applicants' claims and the last for the Stern Report and the Cannon patent; both are erroneous.

In Stern's process, caustic soda is simply used to gelatinize the starch in a water suspension; **not** to "maintain" the **drilling fluid**, to which the gelatinized starch suspension is later added, at a pH of about 12, as set forth in the claims; Stern uses **salt water** to immunize the drilling fluid in which the starch suspension is inevitably diluted to below a pH of 11 or 12, i. e., 10.9; see Appellant's Brief, pp. 20-21.

Note: Again App. refers to the Joint Appendix, Tr. to the transcript before the District Court and Dep. to the depositions. All emphasis are ours.

In the Cannon process, if starch be substituted for tannic acid in Cannon's bentonite drilling fluid, with caustic soda in the amounts prescribed by the Examiner, then the very **objects** of the Cannon process of thinning the fluid will be **defeated**, because the drilling fluid will be thickened and not thinned, and will indeed result in an **inoperable** and not at "an operable well-drilling viscosity," as set forth in the claims; see Appellant's Brief, pp. 26-28.

The Solvay Blue Book simply discloses that 1% of caustic soda in water produces a pH of just under 13; it does not deal with drilling fluids, or such fluids containing a starchy colloid.

Appellant's Statement of Questions Presented is, therefore, incomplete and inaccurate on the very issues involved in this case.

APPELLEE'S COUNTERSTATEMENT OF THE CASE.

Appellee's counsel concede that:

> "* * * an accurate statement of the case can be gathered from pages 2 to 31 of appellant's brief * * *"

Counsel then proposes to present "a more concise statement of the case" because it is asserted that Appellant's statement includes "much argumentative matter."* The rest of Appellee's Brief is, however, argumentative and necessarily so, because Appellee's counsel cannot and do not rely on the evidence but on distortions of the evidence, which evidence is not disputed by Appellee at the trial.

Appellant's challenges were not disputed.

Throughout Appellant's Brief we called attention to the fact that: the demonstrations by Farnham at the trial and by Larsen in his deposition† were **not disputed** and that there was no cross-examination with respect thereto, pp. 20, 27, 28; that the conclusions of the highly skilled witnesses with reference to the Stern and Cannon disclosures were not disputed at the trial, pp. 21, 42, 43; that any particular prior art citation must be considered in its environment as established by the art which preceded it, p. 15; that by following the Examiner's view of the Cannon disclosure, the results of applicant's invention can not and will not be attained, p. 29; that the Patent Office did not dispute that there was a problem in this art and that the application in suit solved that problem, p. 34.

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* In Appellant's Brief, p. 15, we said: "Some of the presentation may appear argumentative, but that is done to connect the facts."

Appellant's Brief is silent on the above challenges; in fact, they are **simply ignored.**

APPELLEE'S SUMMARY OF ARGUMENT.

Appellee's Summary confuses the issues before this Court, because again Appellee's counsel continuously understate and sidestep what is claimed in the process claims in suit and overstate what is disclosed in the prior art. Thus:

> (1) While it was old to use a starchy colloid in a drilling fluid, **Stern** described such use only in a **salt water** fluid, with resultant corrosion of the steel equipment. **Cannon** only described the use of **starch,** an inert material, and not of "a starchy colloid," i. e., gelatinized starch.
>
> (2) **Neither Stern nor Cannon** describe "maintaining" the well-drilling fluid at a pH of about 12, i. e., between 11.7 and 13.3, so as to "maintain" a low water loss, viz., below 5 cc, and all at an "operable

---

† Note that by the Stipulation, App. 133, Appellee's Counsel were specifically given the option to cross-examine Farnham on Larsen's testimony.

well drilling viscosity'' as specified in the claims. **Stern** maintained the water-loss by **salt. Cannon** simply used large amounts of caustic soda with large amounts of tannin **to thin** a drilling fluid containing large amounts of bentonite; **starch,** an **inert** material (not ''a starchy colloid,'' i. e., gelatinized starch) is only incidentally mentioned. As shown above, the **Solvay** Blue Book has no bearing on Applicants' invention.

(3) **The question here is not simply** whether applicants discovered that gelatinized starch could be kept immune from deterioration by maintaining the drilling fluid at a pH of about 12; **the question is** whether plaintiff is entitled to a patent **for a process** based on such a discovery; Appellant's Brief, pp. 39-40. Neither Stern, Cannon, Solvay nor Glyco disclose such a process.

(4) The record in this case shows that the District Court erred in refusing the claims.

Appellant's Statement of Points, Appellant's Brief, p. 32, briefed the true status of applicants' invention as related to the Stern Report and the Cannon patent. That status was not really disputed by Appellant's counsel.

APPELLEE'S ARGUMENT.

We want to reply to Appellee's Argument as follows:

The pH at which the drilling fluid must be maintained, in order to prevent fermentation of gelatinized starch and for the latter to remain effective, is critical.

The assertion by Appellee's Counsel, p. 3, that "there is nothing critical about the precise value of 12," is contrary to the evidence; and the statement in the claims is, "A pH of about 12," which is defined as from 11.7 to 13.3,* and was so accepted by the Patent Office and properly so.** Here again, Appellee's Counsel disregard the evidence summarized in Appellant's Brief, pp. 10, 14, 20-21 and 29; we will, therefore, first quote from the testimony of Farnham and Larsen as to the lowest pH required to inhibit fermentation and then as to the highest permissible pH to prevent caramelization:

As to the lowest pH required to inhibit fermentation:

> "Q. Suppose that you kept your drilling fluid at a pH of 12, and you put in your gelatinized starch. Would fermentation take place? A. No. Whenever the muds are maintained at pH 12 or higher, there will be no fermentation of starch.
>
> Q. Suppose you don't watch it and it goes down below 12, I think the application said 11.5, 11.7? A. Some place below 12 fermentation will start up and unless alkalis are added to the mud as it is in use and the pH will drop downwards" (Farnham, App. 37, Tr. 48).

* * * * * * *

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* See Quotation, Appellant's Brief, p. 10.

** See Smith v. Kingsland, 85 App. D. C. 284, 178 Fed. 2d 26, 28, quoted from in Appellant's Brief, p. 37.

"Q. In all of these three muds, the pH of 9.4, 10.8 and 10.9,*** if they were fresh water muds or not sufficient salt to preserve them, would they ferment, or would they not? A. They would ferment.

Q. In order not to do that, you would have to maintain a pH of about 12, you said, I think? A. In order to prevent fermentation of starch the pH must be approaching 12" (Farnham, App. 51, Tr. 77).

* * * * * * *

"Q. Is that highest, 10.9, sufficient to keep the mud from fermenting? A. No, it is not.

Q. How high do you have to go in order to stop it? A. Above about 11.5.

Q. Then that is on a logarithmic scale? A. That is correct.

Q. So, it is not merely a difference between 10.9 and 11.5, is it? A. No.

Q. There is a rapid increase, isn't there? A. Yes, there is a very great increase in the actual amount of alkali constituent" (Larsen, App. 123, Dep. 73-74).

* * * * * * *

As to the highest permissible pH:†

"Q. Now, was there anything in any one of these tests (a), (b), (c) and (d) which showed that the pH might have been too high and affected the starch? A. Yes, it was observed with muds (c) and (d) that the filtrate from these muds was somewhat dark in color, as though the starch had been perhaps caramelized by the high alkalinity.

Q. A caramelized starch is still an emulsoid colloid? A. As caramelization of starch proceeds, the starch becomes less and less of an emulsoid colloid" (Larsen, App. 129-130, Dep. 85).

*** The pH of a boiled suspension of starch in water, according to Stern, after addition to a drilling fluid and diluted thereby, Pl. Ex. 5, App. 155, 157; Larsen App. 120, Dep. 69, etc.

† Larsen's tests of substituting starch for quebracho, a tannin, in Cannon's process, Pls. Ex. 6, App. 157-158, discussed by Larsen, App. 127, etc., Dep. 80, etc.

* * * * * * *

"Q. Mr. Larsen says he observed that in some of these tests the filter (filtrate) was darker in color showing that perhaps the starch had been caramelized by the high alkalinity. Now, are you familiar with that phenomena; what happens if you use too high pH or use too much caustic? A. Yes, I am.

Q. What happens? A. As he states, the starch will caramelize, which means carrying the decomposition or the hydration of the starch too far, carries it down to the sugars‡ and actually synthesizes it, a new combination is formed, quite a bit as you do when you burn sugar on a heated pan.

Q. Is starch any good when it is caramelized like that? A. No, the caramelization produces compounds that in no way help to reduce the filter loss of a drilling mud, in fact, produces compounds that are virtually water soluble and go to the filter (filtrate)" (Farnham, App. 77 and 78, Tr. 135).

* * * * * * *

"Q. Mr. Farnham, where is the value of the pH where the caramelization of starch sets in? A. Where does it?

Q. Yes. A. It would probably start about 13.2 or 13.3. The time factor also comes in there" (Farnham, App. 78, Tr. 136, on cross).

"Q. It doesn't say it won't work above that, it just says it is not so effective? A. That is right.

Q. Above 13.3, but it is all right up to a pH of 13.3? A. That is right" (App. 80, Tr. 138, on cross).

* * * * * * *

"Q. What do you understand is meant by that? A. I understand that at approximately 13.3 pH and

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‡ That is a complete answer to the Board's Decision, App. 219, questioning that at a high pH "starch would break down to sugar."

> higher, the starch will begin to caramelize and will be less effective as a colloid to add to drilling mud. That caramelization is something that doesn't happen instantly. There is a time factor in there and starch can be used even though caramelization begins. You have lost that amount which has caramelized. It doesn't change black to white at any one specific point" (Farnham, App. 80, Tr. 139).
>
> * * * * * * *
>
> "Q. The one I gave you of 13.6 was 7 grams of caustic and 61 cubic centimeters, as Cannon gives it, which is 13.61. That scale, that pH scale, I think you said it was a logarithmic scale? A. Yes, that is right.
>
> Q. What do you mean by that? A. That means it goes up not as a direct function of the numbers there, but as a power function. From pH 9 to pH 10 or from 11 to 12 is 100 times. It goes up as a power function. That is why it is an accurate scale. At the low pH's, say pH 7 to pH 10, it is a most accurate method of measuring, but when you get up to the pH 13 to 14, it is better to put it in percent by weight of caustic.
>
> Q. When Mr. Larsen found 13.6 or 13.3 with starch apparently was caramelized, was the pH too high or too low? A. Well, at 13.6 is too high. It will cause caramelization of the starch.
>
> Q. And 13.3, how about that? A. 13.3 is about on the borderline, given time, elevated temperatures, it will begin to caramelize, and the starch will be lost from the system in that way" (Farnham, App. 81, Tr. 140-141).

The Patent Office has simply not been able to appreciate that in applicants' process there are **metes and bounds** which are accurately stated in the claims, and which are wholly absent from the prior art relied on. Those metes and bounds are indeed **critical** and unless followed will result in failure.

The District Court did not find that the Cannon patent discloses a process in which a drilling fluid containing a starchy colloid, i. e., gelatinized starch, is maintained at a pH of 12.

Finding 3, App. p. 7, is:

> "3. The patent to Cannon, No. 2,019,858, relates to a drilling fluid for combatting heaving shale, and discloses, inter alia, a drilling fluid including **starch** and caustic soda. Various values are mentioned for the amount of caustic soda, one value being 1%."

There was no finding by the District Court that Cannon disclosed the use of a "**starchy colloid,**" i. e., gelatinized starch as the claims specify, but only of "starch," an inert material. The "inter alia" in the finding was, of course, quebracho and other tannins, the only ones, which, when used with caustic soda, attained Cannon's objects; for starch with caustic soda would defeat Cannon's objects (Appellant's Brief, p. 28).

The last sentence of Finding 3 was then supplemented by Finding 6, the **Solvay** Book giving "the pH value of a 1% solution of caustic soda is just under 13.0." There is in Solvay no reference to a well-drilling fluid, and of course not to such a fluid maintained at a pH of 12; Solvay simply states what the pH of a **water** solution containing 1% caustic soda is.

That Finding 6 was then supplemented by Finding 7, App. p. 7:

> "7. Plaintiff's testimony shows that a 1% solution of caustic soda will gelatinize or hydrolize starch."

Appellee's Brief page 4 seeks to connect up Finding 3 with Finding 7 and cites only one question and its answer by Farnham which simply mentions that Cannon patent. The more complete testimony of Farnham on that phase is as follows on cross: App. pages 73-74, Tr. 115:

> "Q. Now, you mentioned that starch which is not gelatinized if put in water is inert, and does not gelatinize, is that correct? A. Yes.
>
> Q. But you admitted, did you not, if there is enough alkali in the water, that will gelatinize the starch, did you not? A. Yes.
>
> Q. How much alkali does it take to make the starch become gelatinized? A. How much?
>
> Q. How much alkali by percentage? A. It will be about .6 of a percent by weight.
>
> Q. Then if you use as much as 1 percent caustic soda, which Cannon mentions on page 2, then the starch will of necessity gelatinize, will it not, because there is that much caustic soda present with it? A. Yes, it would gelatinize at 1 percent caustic."

Of course, Farnham was simply talking about the known fact that a **water** solution of 1% caustic soda will gelatinize starch. He was **not** talking about what happens in a **drilling fluid.** On redirect, however, Farnham testified, App. 76-77, Tr. 120, 121:

> "Q. I think you said if he used caustic and quaebracho in those amounts, he could get his drilling fluid down in thickness (thinness) as Mr. Larsen stated? A. That is right.
>
> Q. And as you show in your demonstration? A. That is right.
>
> Q. But if you tried that sort of a thing, substituted for quaebracho extract or any of the other tannins, starch, you get what? A. You would get just the opposite, a thickening effect of the mud."

As summarized in Appellant's brief, pp. 26-28, Farnham showed that when in the Cannon process caustic is used with quaebracho, a tannin, the drilling fluid will "be within a usable viscosity range," but when in the Cannon process starch be substituted for a tannin the drilling fluid a mud "has a viscosity that could not be pumped" "you get into trouble" and "would defeat the very thing Cannon wanted to do," i. e., thinning, instead of thickening the drilling fluid.

Those Findings 3, 6, and 7 were proposed by Appellee's Counsel who proceeded, by a series of steps from Cannon to Solvay, to **synthetically** build up the invention of the claims. Those findings were then followed by Finding 8 as follows:

> "8. The claims at bar define no invention over the disclosure of the patent to Cannon" (App. 7).

We submit that the District Court became wholly confused by those series of Findings submitted to him. Appellant attempted to correct them by submitting proposed parallel Findings 3, 3a and 3b (App. pp. 9-10) under Civil Rule 52b, filed the day defendant's findings were entered, but they were not entered, and Plaintiff's Motion for a New Trial (App. pp. 12, etc.), based on those findings, was overruled (App. p. 22) without an opinion.

The question is not whether Cannon discloses "starch," or whether he discloses a drilling fluid which may incidentally have a pH of 12, or whether at such a pH starch will become gelatinized into a starchy colloid.

The question is, does Cannon disclose Applicants' claimed process? Surely, when by the substitution of starch for a tannin in Cannon's process his objects will not be attained, but will result in something inoperable, such a synthetic build-up cannot be Applicants' process producing Applicants' result.

The District Court's Finding 8 was not based on evidence, but was contrary to the evidence; it really an erroneous conclusion of law.

The claims were carefully drawn to define the amount of the starchy colloid added as related to the pH of 12, viz.:

> "* * * adding * * * while maintained at a pH of about 12, sufficient of a starchy colloid to attain and maintain a substantial wall-seal of low water loss, viz., below 5 cc (A. P. I.) and at an operable well-drilling viscosity."*

That was not something empirical; for as shown by Farnham (App. 55, Tr. 84), in connection with the application drawing (App. 145, Fig. 3), when a starchy colloid is added to a drilling fluid maintained at a pH of about 12, to maintain a water-loss below 5 cc, the drilling fluid will have its viscosity increased and not decreased as Cannon specifies in order to attain his objects. Here, again, is another **mete and bound** ignored by the Patent Office and by Appellee's counsel.

Cannon did not specify any mete or bound, even as to starch, an inert material, and certainly not as to "a starchy colloid," viz.: gelatinized starch, and the use of starch in Cannon's process, as a substitute for a tannin, will result in something inoperable.

Cannon's specification of caustic soda addition will not result in such gelatinization of starch as to be effective.

Again, as to caustic soda, the Cannon Patent gives ranges which the Board said "can be varied over a wide range" (App. p. 220), and [redacted] Appellee's Counsel stressed (App. p. 77, Tr. 121) that "the portion of caustic soda, and these other things, may be varied over wide ranges." Cannon specifies from **⅓%** to **7%** (App. 194, right, lines 14 and 49). Appellants' Brief, p. 29, shows that at the lower limit ⅓% starch will not gelatinize, while at the upper limit 7% starch will caramelize.

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* Such expression properly defines the amount of starchy material added. Montgomery v. Marzall, 189 F. (2d) 640, C. C. A., D. C. The Patent Office did not dispute that, neither did Appellee's counsel.

As to the lower limit ⅓%, Larsen testified (App. 109, Dep. 50):

> "Q. Keep in mind, though, that they (Board of Appeals) say that the ratio can be between wide limits. Have you any authorities, scientific authorities, that tell you what pH is required to gelatinize starch where you use caustic soda? A. I can refer you to a couple of papers which state the amount, the minimum amount of caustic soda necessary in your aqueous solution in order to paste or gelatinize starch."

Larsen then cited two scientists, Reychler and Oswald, the latter, "the father of colloid chemistry," who showed that it requires 0.55 to 0.60% of caustic soda to gelatinize starch. Larsen then testified:

> "Q. Have you verified that yourself, experimentally? A. I have verified that myself, experimentally, using corn starch" (App. 111, Dep. 53).

Larsen then showed by reference to his own experiments (Pl. Ex. 4, App. 154) that he found that at 0.5% "there may have been the least bit of incipient gelatinization * * * probably less than one percent" (App. 112, Tr. 56). Starch will, therefore, not be gelatinized by ⅓% caustic soda; that ⅓% is repeated six times in the Cannon specification and even in his claims.

Larsen was confirmed, as to the above, by Farnham at the trial (App. 66-67, Tr. 102-103), who testified:

As to the lower limit of ⅓%:

> "Q. Taking that as a guide, one skilled in the art, as a guide for making up a drilling fluid containing

caustic and quaebracho with bentonite, that was all right, wasn't it? A. That is right.

Q. That was all right? A. Yes.

Q. Suppose that was given you as a guide for making up drilling fluid. Could you select a starch? What would you need? A. One-third of 1 percent, say, of caustic soda is not enough to cause the starch to gelatinize.

Q. In other words, even if we take the examiner's idea of using, say, one-third of 1 percent and starch, by that you wouldn't get gelatinization, would you? A. No, you wouldn't get gelatinization.

Q. You would have to go up to almost twice that amount, wouldn't you? A. Yes.

Q. Using Cannon's guide book as in excess of one-third of 1 percent, which is repeated five times in each of the claims, that wouldn't be made possible, would it? A. No, that wouldn't."

As to the upper limit 7%. We have shown, pp. 9, etc., supra, by the testimony of Larsen and Farnham, that caramelization took place when the pH was too high by the use of too much caustic. Larsen's drilling fluid (d) (Pl. Ex. 6, App. 157, 158) contained 7% caustic, and (c) contained 2% caustic, and both caramelized the starch as shown, pp. 9, etc., supra.

Appellee's Counsel have not disputed the following statement in Appellant's Brief, p. 29:

> "It will, therefore, be seen that if we follow the Cannon Patent as to the lower limit of ⅓ of 1% caustic that will not be sufficient to gelatinize starch; but if we follow Cannon as to the high 7% caustic then that will be too high and will result in caramelization of the starch."

Here, again, appellee's counsel simply ignore our assertions.

Nor have Appellee's Counsel disputed the application of this Court's opinion in Becket v. Coe, 69 App. D. C. 51, 98 Fed. 2d 332, 335, 336, quoted from in Appellant's Brief, p. 47; the language there is certainly apropos, particularly the following:

> "This type alloy is mentioned only as a variant of a chromium-nickel-manganese alloy, with neither details as to what different results would be obtained, nor any indication that the metal would resist staining." p. 335.
>
> "One seeking a stainless deep-drawing alloy and finding the Hadfield (French) and Commentry (French) patents could not have said: 'These give me what I want.' " p. 336.

In the Cannon patent starch (not a "starchy colloid," i. e., gelatinized starch) is referred to "only as a variant" of quebracho, a tannin, "with neither details as to what different results would be obtained"; in fact, the undisputed evidence shows that to substitute starch for tannin with the proportion of caustic soda prescribed by the Examiner for use with the tannin would defeat the very objects of the Cannon process, i. e., of thinning the drilling fluid, because the opposite, thickening, will take place, yes to the extent that the drilling fluid will become inoperable. See Appellant's Brief, App. 26, etc.

It is seldom that we find such a complete answer to a distortion of a prior art citation as we have here, contrary to the undisputed evidence in this case, and contrary to the law as applied by this Court, which Appellee's counsel simply ignore.

The Stern Report does not disclose maintaining a drilling fluid at a pH of about 12.

Appellee's Brief, p. 5, distorts that Report as does Finding 4, App. p. 7 prepared by Appellee's Counsel. That is apparent if we compare the two:

Stern Report, App. p. 203.	**Finding 4**, App. p. 7.
"It is only recently that starch has found application in drilling muds as a result of the development that hydrolyzed starch imparts a good filter test to salt-water mud. For this purpose, the starch may be hydrolyzed by boiling a 10 percent starch suspension in sodium hydroxide (1 percent by weight; or starch: Sodium hydroxide 10:1). A pH of about 11 or 12 has been found desirable."	"4. The publication by Stern, pp. 76 and 77 of the Report of Investigations No. 3556 of Bureau of Mines, refers to the use of hydrolyzed starch in well drilling fluid. It states that a pH of about 11 or 12 has been found desirable. This refers to the pH value of the drilling fluid. The starch suspension is prepared with sodium hydroxide."

By astute placing of sentences in the finding, with the second sentence preceding the last sentence and with the interposition of a third sentence, having no foundation in the Stern Report at all, the finding reconstructs the entire Stern disclosure.

Of course, Appellee's counsel wholly ignore the very next sentence of the Stern Report:

> "One important point is that starch tends to ferment **unless** a preservative is added. An effective preservative is sodium chloride (salt), so that it is possible to accomplish a dual function when drilling through a salt formation."

In Appellant's Brief, pp. 40-41, we said:

> "Is it possible that Stern in 1941 disclosed to the art preventing fermentation by and maintaining a drilling fluid at a pH of 12, when he describes for that purpose the use of equipment-corroding salt and even alcohol? Would the art have continued for over two

> years with limiting the use of gelatinized starch to areas where salt domes were drilled through in the course of drilling for oil?"

Appellee's Counsel have wholly ignored those queries, although Farnham's testimony on that phase, quoted from in Appellant's Brief pp. 7 and 8, was **not disputed** at the trial; in fact, he was **not even cross-examined** as to that phase.

Furthermore, if the sentence in Stern's Report, "A pH of about 11 or 12 has been found desirable," applies to the pH of the drilling fluid, then it is **misleading** because a pH of 11 is not sufficient to prevent fermentation; for to prevent that the pH must be at least 11.7, as shown above, p. 8, supra. Accordingly, one following the Stern Report, as done by the Patent office, **would go astray.**

Note here that in order to merely gelatinize starch in a **water** suspension, the pH can be as low as 11, where, as prescribed by Stern, gelatinization is carried out **by boiling.** In actual practice, however, it is that gelatinized suspension which is added to the drilling fluid (Pls. Ex. 7, App. 159, 167); of course, that results in dilution with accompanying reduction of pH; p. 9, supra.

Applicants have been very specific in their specification and claims by specifying "a pH of about 12" (between 11.7 and 13.3), i. e., by prescribing the lower limit where fermentation of gelatinized starch will be prevented and the upper limit where there will be no caramelization of the starch. The Patent Office and the District Court do not differentiate between a pH sufficient to **simply gelatinize** raw starch **in water,** and a pH at which it is necessary to "maintain" a drilling fluid containing gelatinized starch to inhibit fermentation, but at the same time avoid caramelization of that gelatinized starch, all as specified in the claims.

The Stern and Cannon descriptions must be considered in their environments.

Appellee's counsel have also wholly disregarded the fundamental principle of Patent Law and, indeed, of common sense, which we stated in Appellant's Brief, p. 15, as follows:

> "In the consideration of any particular prior art writing, whether a publication or a patent, it is no more than common sense that the same be considered in its environment and in a manner as one skilled in the art would consider it with what was previously known."

That principle, we showed, is supported by law, Appellant's Brief, pp. 43-44. The application of that principle to this case has not been disputed by Appellee's Counsel; they simply ignore it.

We showed in Appellant's Brief, p. 16, that the ratio of 10 to 1 of starch and caustic soda, prescribed by Stern to gelatinize starch **in water**, has been followed from 1888 to the very date of Stern's Report in 1941. We furthermore showed, Appellant's Brief, p. 16, that those skilled in this art so read the Stern Report. Professor Dodge, whose theoretical and practical experience in this art goes back to 1925, App. 149, after quoting from the Stern Report, said, under oath, App. 153-154:

> "That statement does not teach me, and did not teach me at the time that I read it, that the drilling mud or fluid itself was to be maintained at a pH of 11 or 12. Furthermore, that publication does not disclose the employment of sufficient starch to a drilling fluid or mud, brought to or maintained at a pH of about 12, in order to attain a substantial wall-seal of low water-loss, viz., below 5 c. c. (A. P. I.) at an operable well-drilling viscosity."

That and no less is specified in every claim in suit. Dodge was confirmed in that respect by Farnham at the trial, App. 46, Tr. 68-69, and by Larsen, App. 117, Dep. 64. That is also supported by Gray et al. paper, Pl. Ex. 7, App. 159, pp. 4 and 7, of the same month and year as the Stern Report, App. 201, 208; both are quoted from in Appellant's Brief, pp. 16-17. It is also supported by the Chapman patent, No. 2,399,986, Pl. Ex. 14, App. 189, original application filed July 1, 1940, App. 191, right, lines 23-25, i. e., eight months before the Stern Report. Chapman described the following, App. 189, right, lines 20-23:

> "In connection with the gelatinizing of starch with caustic, it is the practice to use the starch and the caustic in a weight ratio of about 10 to 1."

That patent then describes the use of salt "to prevent fermentation of the starch," App. 191, left, last line, and claims, right:

> "8. A salt water drilling fluid containing a filtration reducing amount of a gelatinized starchy material."

The above is exactly what Stern described. None of the above was disputed by appellee's counsel; they simply ignore the facts as established by the evidence. It was on such distortions of the Stern Report that the following Finding 9, App. 7 (really a conclusion of law), was based:

> "9. The claims at bar define no invention over the disclosure of the publication by Stern."

Again, Appellant attempted to correct that distortion by Appellant's Proposed Findings 4 and 4a, App. 10 and 11, based on the evidence, but again without avail, and Plaintiff's Motion for a New Trial was overruled without an opinion, App. pp. 12, 22. Here, again, we believe that the District Court became confused, because Findings 4 and 9, App. p. 7, are not supported by the evidence, but are contrary to the evidence.

Cannon plus Stern does not produce Applicant's invention.

The attempt, Appellee's Brief, page 6, to rely on Cannon plus Stern must fail because neither discloses applicants' claimed invention. How can Stern, which discloses immunizing a drilling fluid containing gelatinized starch by a concentrated **salt** solution, supplement Cannon whose object is to use a drastic **thinner** for a high percentage bentonite drilling fluid, and which will become inoperable if starch be substituted for the crude tannin quebracho. To combine the Stern and Cannon disclosures, two unequals and neither the equal of applicant's invention, is about as sensible as to say that the ancient mathematical axiom should read:

unequal + unequal = an equal.

What Appellee's counsel have done is to repeat the distortion of the Stern and Cannon disclosures, apparently in the belief that repetition will convince this Court.

Applicants' process is based on a discovery.

Appellee's Counsel in their brief, p. 6, tacitly concede that the Applicants made a scientific discovery; so did the Examiner, Def. Ex. F, App. 204, 209. But Appellee's Counsel say:

> "Assuming that applicants made the scientific discovery referred to by appellant, it does not follow that a patent may be granted merely on the basis of that discovery."

Appellant's Counsel have never contended that a discovery alone is patentable, but that a new and useful **process based on such a discovery** is. The decisions of the Supreme Court and of this Court cited and applied in Appellant's Brief, pp. 36-40, have not been controverted; they are simply ignored.

Appellee's Counsel in their brief quote the District Court's Conclusion 1, it is as follows, App. p. 8:

> "1. The discovery of a hitherto unstated property of a well drilling fluid containing starchy colloid and sufficient caustic soda to make the pH value about 12 is not such a discovery as entitles plaintiff to a patent therefor."

That conclusion cannot apply to **Stern** who described a stated property of immunizing a drilling fluid by a concentrated **salt** solution and not by maintaining it at a pH of about 12. It cannot apply to **Cannon**, who disclosed a stated property of **thinning** the drilling fluid, while the substitution of the tannin by starch would thicken the drilling fluid, defeat Cannon's object and render it inoperable. The conclusion is not based upon the application of law to the evidence at all.

Roberts v. Ryer, 91 U. S. 150, cited Appellee's Brief, p. 7, and In re Jones, 120 Fed. 2d 1019, CCPA, do not apply here at all, because in both cases the prior art disclosed **the same material things** as did the patent and application in those suits, and there was nothing critical; such is not the case here.

Roberts v. Ryer involved a refrigerator which had an endless air passage therein, providing for up and down draft, 91 U. S., p. 156; so had the prior Lyman patent, p. 157; accordingly, the Supreme Court said, p. 158:

> "* * * They each had both, and could utilize both. It is no invention, therefore, to make use of one rather than the other."

In re Jones, as appears from 120 Fed. 2d, pp. 1019-1021, involved a method of treating a drilling fluid with, among others, bicarbonates to reduce the filtration rate into the formation. A prior publication also treated the drilling fluid with bicarbonates for reducing the viscosity, but did not describe its function as for reducing filtration of the drilling fluid. The Court, therefore, properly said, p. 1021:

> "Appellant discloses the use of nothing but carbonates and bicarbonates. The reference **discloses** the use of these **same substances.** It is clear that those substances modify the viscosity of the contaminated drilling mud as disclosed in the reference. Appellant has probably discovered that the use of carbonates and bicarbonates also reduces the filtration rate in contaminated drilling mud. In all likelihood the author of the reference had no purpose in his use of those substances except to reduce the viscosity of contaminated drilling mud and possibly the benefit derived from their use on the filtration rate of the mud was not thought of by him. This latter benefit, however, is **inherently** present in the use of carbonates and bicarbonates as agents for reducing the viscosity of the mud.
>
> "If the carbonates and bicarbonates reduce the filtration rate in the drilling mud as claimed by appellant, they surely must have the same effect upon the mud of the reference. While the amounts of mixing materials disclosed in the reference are quite small, there appears to be **nothing critical** in the said amounts. * * *"

That was an entirely different case than we have here. The **procedure** was the **same** in the Jones application and in the prior art reference and the **materials** were the **same,** so that the **result** was inevitably the **same.**

Here the **Stern** Report procedure is to gelatinize starch in **water** and then add the gelatinized starch-water suspension to a drilling fluid so that its pH by dilution will **inevitably** be less than 12, indeed about 10.9, and immunization is attained by maintaining a concentrated **salt** solution and not a pH of about 12. The **Cannon** patent procedure employs a tannin (quebracho) and caustic soda to thin the drilling fluid. Cannon discloses the use of starch, **not** "a starchy [redacted] colloid," i. e., **gelatinized starch,** as a substitute for the tannin, but, again, to attain the same object, namely, thinning, certainly not **the opposite,** thickening, which would defeat Cannon's object and with all render the drilling fluid inoperable, because not "at an operable well-drilling viscosity" as stated in the claims. There is **nothing inherent** in the Stern and Cannon disclosure which will result in applicants' invention.

Here, also, the pH is maintained at a critical value, viz., about 12, i. e., from 11.7 to 13.3; for if too low the drilling fluid will not remain immunized, but if too high the starch will caramelize and defeat the object of applicants' invention. Those metes and bounds, as well as others, are set out in the claims.

This case is, therefore, not one as asserted in Appellee's Brief, p. 7, that the public will be deprived "on the expiration of the Cannon patent to use everything taught therein, with all the results flowing therefrom"; for Cannon does not disclose Applicants' process and the result disclosed by Cannon is the **very opposite.** Furthermore, Cannon does not disclose a "drilling fluid containing gelatinized starch and caustic soda," but at most, starch, an inert material, and if it be attempted to gelatinize that starch in Cannon's process, the result will be inoperable. The testimony on the above has not been controverted.

THE QUESTIONS OF PATENTABILITY AND INVENTION APPLICABLE HERE.

We fully realize that the standard of invention has been raised in the last decade, although the question of validity and what amounts to a patentable invention under R. S. 4886, 35 U. S. C. 31, is **a question of law** upon the evidence before this Court; A. & P. Co. v. Supermarket Corp., 340

U. S. 147, 156; Standard Co. v. Marzall, 86 App. D. C. 210, 181 F. 2d 280, 283. However, there are certain fundamental principles of Patent Law which have been established by the courts and those have not changed. We, therefore, want to refer to a number of decisions, mainly by this Court.

In re Haskell, 51 App. D. C. 243, 278 Fed. 326, involved **a process** resulting in a **defined result.** The Court said:

> "* * * It is one thing to conceive the idea that a certain result is possible and quite another thing to demonstrate the possibility; that is, actually devise means to accomplish the result and convert the possibility into a reality" (p. 327).

* * * * * * *

> "Gardner evidently did not appreciate the necessity of combining the ingredients in the manner employed by the applicant and makes no mention of mixing such materials 'until the mass becomes of a homogeneous syrupy consistency.' This is important and goes far toward demonstrating that applicant and not Gardner really is the originator of the subject-matter of the claim here under consideration" (p. 328).

The above principles apply to the Stern Report and Cannon patent, who fail to disclose applicants' claimed invention. In that case, also, a publication later than the Gardner British patent stated that the results obtained by Haskell had not been attained; the Court says:

> "In other words, the British patent did not disclose to Luther, an expert, what the Patent Office has ruled, in effect, must have been disclosed to the applicant here" (p. 328).

Here Stern in his report of 1941, three years after the issue of the Cannon patent, and after referring to the Cannon patent, App. p. 202, says, p. 203:

> "It is **only recently** that starch has found application in drilling muds as a result of the development that hydrolized starch imparts a good filter test to salt-water mud."

Later, Cannon's assignee, Chapman, showed that Cannon disclosed what we have contended, see Appellant's Brief, pp. 30-31.

In re Wescott, 53 App. D. C. 32, 287 Fed. 1009, involved **a process.** Like here (as to Cannon) there it was also shown by one skilled in the art that the prior art process (Bennet) **could not operate** as did the applicant's. The Court says, p. 1011:

> "It is not disputed that unless these conditions obtain applicant's method would not be a success; that is, would not be operative."

Further, as to another prior art disclosure (Ives), the Court says, p. 1011:

> "Not only is there a total absence in Ives of an intent to reach the result achieved by the present applicant, but his disclosure contains nothing that, in our view, would enable anyone entertaining such an intent to achieve that result."

The procedure in the Patent Office was like it has been here; the Court says, p. 1011:

> "* * * A reading of the decisions of the three tribunals of the Patent Office reveals that, in this obscure and highly technical art, they have reached a conclusion adverse to the applicant because, in the light of his disclosure, they are of the view that anyone skilled in the art could have taken the various references (no one of which is in itself sufficient) and achieved the result reached by him. While a post mortem diagnosis may be valuable, it hardly will be

> denied that a timely diagnosis, resulting in the saving of life, is of much greater value. There is the same difference in the relative values of an original or real invention and one of the post mortem sort. The one involves the exercise of creative genius or power; the other mere deductions."

Hartford Empire Co. v. Coe, 66 App. D. C. 344, 87 Fed. 2d 741, also involved a **process** in which the Patent Office took the following position disposed of by this Court as follows:

> "* * * In other words, it means that any person skilled in the art would have been able to proceed against the teachings of Hitchcock that the glass should be heated to a thin liquid form and fed in ball and tail, or drop in thread charges and change the Hitchcock method, structure, and mode of operation to perform Peiler's pasty glass suspended charge feeding method. We have had occasion in many instances to condemn the hindsight nunc pro tunc method employed to justify the refusal of valuable inventions in which the patentees are entitled to the protection afforded by the Constitution and the laws" (p. 744).

Here the Patent Office again takes the position that one skilled in the art would **go against the teachings** of Stern and not to immunize the drilling fluid by salt, and against the teachings of Cannon and not to thin the drilling fluid but to thicken it, even though the latter would defeat Cannon's object and result in something inoperable.

We realize the burden on an applicant in a R. S. 4915 proceeding, particularly where the District Court has affirmed the Patent Office. However, that burden is not an impossible one; for this Court has the power like any other Court to determine whether the findings of the District Court are supported by the evidence or are contrary to the evidence. Appellee's counsel in their brief, p. 8, rely on Besser v. Ooms, 81 App. D. C. 7, 154 Fed. 2d 17. This Court at page 18 cited:

Poulsen v. Coe, 73 App. D. C. 324, 119 Fed. 2d 188. That case involved **a process**, p. 195. This Court says, p. 197:

> "We think that the appellants' improvement was not anticipated in Robinson and Hewlett and that the rejection by the trial court and the Patent Office was demonstrably the result of clear error in respect of the foundation for rejection."

That was because in that case apparently the Patent Office was misled by concentrating upon elimination of background noise rather than upon the solution of the problem of asymetrical distortion and by disregarding the history of the art; this Court said, p. 198:

> "We think moreover that the improvement made by the appellants, simple though it may seem from the point of view of hindsight, was inventive in character. * * * 'Is it not clear that the quality of a man's inventiveness must be tested by reconstituting the situation as it was in the light of the preceding history of the art?' "

After so considering the prior art, this Court says, p. 199:

> "* * * If the appellants were to solve the problem of distortion and at the same time retain for the art the advance made by Robinson and Hewlett, they must go contrary to the teaching of the art as it stood under Robinson and Hewlett."

* * * * * * *

> "* * * We think it took that boldness, clarity of vision and ingenuity characteristic of invention, as distinguished from mechanical skill, to attempt the voyage upon which the appellants set out and to sail it successfully so that at the end both the Scylla of

> distortion and the Charybdis of background noise were eliminated for the future of the art."

Here the state of the art prior to **Cannon** showed that what Cannon disclosed was the **usual employment** (Lawton et al.) of a tannin and caustic soda **to thin** a drilling fluid; he simply employed greater quantities of those agents with larger quantities of bentonite. Applicants, on the other hand, employ "a starchy colloid," i. e., gelatinized starch, not disclosed by Cannon and which thickens rather than thins the drilling fluid, something the **exact opposite,** and which would defeat Cannon's object and render his process inoperable. As to **Stern,** again the prior state of the art showed that Stern proceeded in the **usual way** and gelatinized starch in **water** with caustic soda which was then added to the drilling fluid and Stern relied on **salt** to immunize the drilling fluid when starch was added thereto.

After Abbott v. Coe, 71 App. D. C. 195, 109 Fed. 2d 449, cited by the District Court, App. 6 and again by Appellee's Counsel, Appellee's Brief, p. 8, this Court reversed the District Court and the Patent Office in **Levin v. Coe,** 76 App. D. C. 347, 132 Fed. 2d 589. That case involved **a process** of treating grain germs to extract therefrom substantially all of the oil without affecting its vitamin content. This Court says, p. 591:

> "The position of the Commissioner is that to obtain the appellant's product it is only necessary to follow Hoffman's use of a hydrocarbon solvent in freeing the wheat germ from oil and then to remove the solvent from the residue constituting Hoffman's intermediate product."

There one reference was relied on to extract the oil but the end product was a sugar and did not retain the wheat germ.* This Court says, p. 597:

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* Here when the pH is carried above 13.3, the result will be caramelized starch, a sugar, and the starch will not be retained as gelatinized starch. See p. 10, supra.

> "Under the uncontradicted evidence the appellant's process for the first time combined the elements of the prior art and achieved a new result, a wheat germ product palatable for human consumption and stable."

In Poulsen v. Coe, supra, in reversing the Patent Office, this Court said, 119 F. 2d, at page 200:

> "Since in our view the findings and conclusions of the trial court and the rulings of the Patent Office were in clear error on the question of anticipation, and since we think it clear also that the appellants' advance was inventive in character, we are obliged to reverse in respect of claims 72, 73, 74, 76, 77, 78 and 79. Abbott v. Coe, 1939, 71 App. D. C. 195, 109 F. 2d 449."

The above cases show that this Court still considers the evidence and evaluates the evidence in order to determine whether the District Court's decision is supported by or is contrary to the evidence.

CONCLUSION.

In conclusion, we submit that this is certainly a case where the District Court and the Patent Office should be reversed. This case does not involve a mere discovery of a result of a process otherwise old. The process is new in its manipulative steps, as stated in the broadest claim, which we will, for convenience, again repeat as follows:

> "Claim 3. In the art of drilling wells by the employment of an aqueous mud-laden drilling fluid the process comprising, adding to such a fluid, while maintained at a pH of about 12, sufficient of a starchy colloid to attain and maintain a substantial wall-seal of low water loss, viz., below 5 cc. (A. P. I.) and at an operable well-drilling viscosity."

That process is not disclosed in the Stern Report nor in the Cannon patent; indeed, the Examiner so admitted when he said, Def. Ex. F, App. 204, 209:

> "The Examiner does not contend that these references teach the basic principle of applicant's discovery. . . ."

Applicants' process is not limited to a situation, as is the case of Stern where the drilling is through salt, but its use is universal including even cases where gypsum is encountered and even where the drilling is through cement; Appellant's Brief, p. 12. Farnham's Summary, Pl. Ex. 12, App. 187, of gelatinized starch sold by his company shows that during two years following the Stern Report of 1941, the use of gelatinized starch in drilling was almost insignificant, because limited to areas where the drilling was through salt. However, after the advent of applicants' invention in 1943, the sales rose in an almost arithmetical progression and finally covered not only the Gulf Coast, where drilling is through salt, but covered all areas, even in foreign countries.

To say that Cannon had disclosed the solution in 1938, without anyone using it until the advent of applicants' process in 1943, five years later, is just against plain common sense. Why should Stern in 1941 refer to the Cannon patent and then say that the application of starch to drilling fluids was "only recently" and that to avoid fermentation salt should be used? Why should Cannon's assignee assert in the Chapman patent as late as 1946, eight years after Cannon, that the Cannon patent does not disclose starch for this use and that it is not possible to so use it as prescribed by Cannon? See Appellant's Brief, pp. 30-31.

The District Court wholly disregarded the evidence by four men highly skilled in this art. We pointed out again and again in Appellant's Brief, pp. 20, 27, 28, that on determinative phases of the evidence the Commissioner's attorney did not even cross-examine those witnesses and that no one from the Patent Office disputed that evidence. But in their Brief, as at the trial, the Commissioner's counsel do not challenge the evidence. They simply content themselves with distortions of the prior art and by citing decisions which have no bearing on this case.

This invention did not evolve out of laboratory work, but was the result of two practical men working in the field. It is not a detail thing but involves a fundamental process based on a discovery. The claims accurately state the metes and bounds to fully comply with R. S. 4888 as lately construed by this Court in Montgomery v. Marzall, 189 F. (2d) 640, supra; indeed the Patent Office has not questioned that.

It is believed that this Court will come to the conclusion that the applicants have made a real contribution to this art and that it finds no disclosure in the prior art. Surely an advance in this art which has been found so important that our Government in wartime permitted and indeed encouraged the use of an essential food in well drilling by the trainload, App. 40-41, Tr. 58, in order to keep our oil production going, should not be denied patent protection because of prior art which did not and does not disclose such an important invention.

Respectfully submitted,

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St. Louis, Missouri,
October, 1951.

No. 10,873.

APPELLANT'S PETITION FOR REHEARING.

UNITED STATES COURT OF APPEALS

FOR THE DISTRICT OF COLUMBIA CIRCUIT.

United States [illegible]
District [illegible]
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NATIONAL LEAD COMPANY, a Corporation,
Appellant,

vs.

JOHN A. MARZALL, Commissioner of Patents,
Appellee.

Appeal from the United States District Court for the District of Columbia.

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No. 10,873.

APPELLANT'S PETITION FOR REHEARING.

UNITED STATES COURT OF APPEALS

FOR THE DISTRICT OF COLUMBIA CIRCUIT.

NATIONAL LEAD COMPANY, a Corporation,
Appellant,

vs.

JOHN A. MARZALL, Commissioner of Patents,
Appellee.

Appeal from the United States District Court for the
District of Columbia.

It is respectfully submitted that this Court has considered what the application in suit claims as well as describes, in a broader aspect than what is specifically set out in the claims and supported by the specification. The claims are not broad, but are indeed limited to definite procedural steps so as to attain a definite result characterizing the invention and distinguishing from the Stern and Cannon references as viewed by this Court. This petition therefore assumes the constructions of those two references and what they disclose, as set out in this Court's opinion. However, there are certain facts supported by the record to which we want to call this Court's attention and which we believe warrant a decree in Plaintiff's favor on the claims in suit.

We will first quote the broadest claim, which is Claim 3, and then the summation from Appellant's Brief, page 2, the latter quoted in this Court's Opinion, page 3. We have, however, emphasized parts both in the claim and in the summary:

> "Claim 3. In the art of drilling wells by the employment of an aqueous **mud**-laden drilling fluid, the process comprising, adding to such a fluid, **while maintained** at a pH of about 12, sufficient of a starchy colloid to attain and **maintain** a substantial wall-seal of low water loss, viz., below 5 cc (A. P. I.) and **at an operable well-drilling viscosity**."* App. p. 212.
>
> "The characteristic feature of the invention resides in **maintaining** the alkalinity of the drilling fluid at **a definite value**, so as to **not only attain**, but to **maintain** the wall seal at a 'low water loss,' during the course of drilling, but with all at an **operable viscosity** or consistency. The specification and the claims, as will be later shown, express the alkalinity as well as the water loss in well known scientific terms, the former as 'at a pH of about 12' and the latter as 'below 5 cc.'" Appellant's Brief, p. 2.

First: The claim does not simply specify the preparation of a drilling fluid with a pH of "about 12" (11.7-13.3), but a **definite method of procedure** in which such a drilling fluid is **maintained** at such a pH so that with the addition of sufficient gelatinized starch the drilling fluid will not only "attain" but "**maintain**" a water seal of low water loss, viz., below 5 cc. That result will follow from the procedure claimed, for fermentation will be inhibited during the course of drilling, because the pH is so **maintained**.

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* As in Appellant's Brief, reference App. is to the Joint Appendix, Tr. is to the Transcript, and Dep. is to the Deposition pages. All emphases are ours.

Stern: Assuming that the Stern publication, App. 201, 202, discloses a drilling fluid which as initially prepared has "a pH of about 11 or 12", Stern does not disclose any **method of procedure** whereby that pH is **maintained** during the course of drilling. This Court says in its Opinion, pp. 3 and 4:

> ". . . Unless the fluid is maintained with a pH of about 12 the continuous introduction of clay salts and water would change the degree of its alkalinity essential to the desired result."

That Stern did not contemplate or disclose the maintenance of the pH during the course of drilling is clear from the following extracts from the paragraph immediately following his reference to the pH, because there Stern describes the use of **salt** and **alcohol** to prevent fermentation as follows, App. 203:

> "One important point is that starch tends to ferment unless a preservative is added. An effective preservative is sodium chloride (salt) so that it is possible to accomplish a dual function when drilling through a salt formation."
>
> "Barnes (7) also proposes the use of starch, with an alcohol, to attain the same objective."

The method of procedure here claimed is not disclosed by Stern.

Second: The claim specifies a **method of procedure** in which "an aqueous **mud**-laden" drilling fluid, that is, one made up of clay and water, is not only **maintained** at a pH of about 12 with the addition of gelatinized starch, but that such a procedure is so carried out to attain and **maintain** a substantial wall-seal of low water loss, viz., below 5 cc (A. P. I.) and **at an operable well-drilling viscosity.**

The above was appreciated by this Court in its Opinion, pages 2 and 3, as follows:

> "... The viscosity of the drilling fluid is critical, because if the fluid is too thin the cuttings will not be carried out of the hole, and if too thick, the fluid cannot be pumped out and will not deposit its cuttings."
>
> "Viscosity of the fluid must be maintained at a consistency which will enable it to convey the cuttings and also seal the bore hole. This is accomplished by treating the fluid with gelatinized or hydrolyzed starch."
>
> "... With the fluid at a pH of about 12 (the range given is between 11.7 and 13.3) starch can be added in amounts to hold the water loss to below 5 c. c., while the fluid is held to an operative drilling viscosity, without deterioration of the starchy colloid by fermentation."

Cannon: Assuming that Cannon, App. 193, 194, discloses a drilling fluid which as prepared in the examples, App. 194 right, will have a pH of just under 13 and which when starch is added thereto will gelatinize the starch, what will the result be? The answer is found in the testimony of Farnham and of Larsen which was **not disputed** at the trial.

Larsen first took the examples of the Cannon patent, App. 194 right, that is, the composition of water, bentonite (a clay) caustic soda, **quebracho** (a tannin), and the results are given in Plaintiff's Exhibit 6, App. 157-158, under (A), (B), (C), and (D) discussed by Larsen, App. 126-129, Dep. 80-84. All were **operative** with the possible exception of the fourth example. However, when **starch** was substituted for quebracho, as shown in the parallel examples (a), (b), (c), and (d), App. 158, then the results were "**viscosity too high to measure.**"

Larsen testified, App. 129, Dep. 83:

> "None of the starch muds, namely (a), (b), (c), and (d), could be used as a drilling fluid because they are **pastes** rather than mud."

Farnham, App. 60 etc., Tr. 91 etc., actually demonstrated before the District Court the action of quebracho and starch respectively, with Bentonite and caustic soda in water, based upon the example of the Cannon patent proposed by the Examiner, App. 210 and one of those tested by Larsen, i. e., substituting 2% of starch for 2% of quebracho, and Farnham obtained the same results as did Larsen.

Farnham then considered all of Larsen's tests on all of the Cannon patent examples and testified (App. 65, Tr. 100-101):

> "Q. Now, take that first one, where you used 1 gram of caustic, or the one where you used 2 grams of caustic (quebracho), it doesn't make any difference, and where you use caustic with **quebracho** in A, B, C and D. They all worked, didn't they? A. Yes, these muds made up represented as A, B, C, and D would be within **a usable viscosity range.**"
>
> * * * * * * *
>
> "Q. Mr. Larsen took A, B, C and D and paralleled it by a, b, c, and d, and substituted **starch** for caustic (quebracho). Do any of those drilling fluids work? A. No, the **viscosities are too high to measure** on the Stormer Instrument, and any mud that has a viscosity that high **could not be pumped.**
>
> "Q. One of those experiments you performed shows what happened, doesn't it? A. Yes."

Farnham's and Larsen's tests were **not disputed** by the Commissioner's counsel who did not even cross-examine Farnham on them, although the Stipulation, App. 133, conceded the right to do so.

The procedure here claimed is not disclosed by Cannon who does **not** disclose that when starch is substituted for quebracho, a drilling fluid, "at an **operable** viscosity," is attained, but to the contrary will be at an **inoperable** viscosity.

Third: The pH of about 12 as specified in the claim is **critical**, i. e., it cannot be below 11.7 or above 13.3, and the claim specifies that the procedure is one in which the drilling fluid is "**maintained** at a pH of about 12" (117-133).

Cannon specifies caustic soda between the wide limits of ⅓ of 1% to a maximum of 7%, App. 194 right. However, at the **lower limit**, starch will **not** be **gelatinized**, while at the **higher limit**, starch will **caramelize** into something like sugar which will not reduce the filter loss. That was shown by Farnham, App. 76-78, Tr. 120, 134-135, who confirmed Larsen's tests, App. 109-113, Tr. 50-57.

Stern mentions "a pH of about **11** or 12." If that pH applies to the drilling fluid, then at a pH of **11, fermentation** will take place; Farnham App. 37, Tr. 48; Larsen App. 123, Tr. 73-74. That is true even though, as Farnham shows, App. 46, Tr. 68, at a pH of 11 starch will gelatinize if boiled in water as actually proposed by Stern in making gelatinized starch, App. 203. Again, the above was not disputed by Commissioner's counsel at the trial.

Resume: It is clear from the above that neither Cannon nor Stern discloses a method of procedure in which the drilling fluid is:

> "**maintained** at a pH of about 12" (11.7-13.3),
> "**maintain** a substantial water seal of low water-loss"
> "at an **operable** well-drilling viscosity."

It is apparent that one skilled in the art reading the Stern and Cannon disclosures would not gather therefrom the above **definite procedural steps** nor attain the **results**, all as specified in the claims. It would be a matter of **hit and miss**, with not more than a 50% chance of making a hit, and with at least a 50% chance of making a miss.

We want to answer this Court's query in the Opinion, page 4:

> "In the aggregate of these prior disclosures of Cannon and Stern, what can be pointed to as missing which appellant supplied?"

Assuming that a well-drilling fluid containing starch and caustic soda, even prepared at a pH of 11 or 12, was known, and that it was also known that when the solution containing 1% of caustic soda at a pH of 12, the starch would gelatinize; neither was an answer to Plaintiff's definite and successful process involving **a method of procedure** as set forth in the claims and described in the specification, as involving the following factors:

(1) Not only attaining a pH of 12, even for a drilling fluid, but **maintaining** such a pH during the course of drilling so that the water-loss will be maintained at a low value.

(2) **Maintaining** a mud-laden fluid, i. e., one containing clay at an **operable** well drilling viscosity with successive additions of starch to maintain such low water loss during the course of drilling.

(3) **Maintaining** the drilling fluid at a definite pH of 12, i. e., (between 11.7 and 13.3) that is high enough (11.7) to prevent fermentation, but not so high (beyond 13.3) where caramelization to something like sugar will occur rendering the gelatinized starch successively less ineffective.

The process does not simply involve "the experimental step between the needed composition of the preparation and of the mud itself", Opinion, page 5; for that was no solution of the problem and factors (1), (2), and (3) go beyond that. Nor does this case simply involve "increase in knowledge of its (starch-caustic-fluid) properties", Opinion, page 5, because phases (1), (2), and (3) involve **a definite method of procedure** beyond what is disclosed by Stern or Cannon. Nor does this case simply involve "the step between any uncertainty residing in the prior disclosures and the certainty arrived at by appellant's assignor", Opinion, page 5; for neither Stern nor Cannon discloses any of the **meets or bounds** as to what should be **done or avoided** during the course of drilling; and as shown under "THIRD" above, it would be a matter of **hit or miss** for someone to practice Plaintiff's processes and obtain the results. That will not do in patent cases.

Finally, this case as presented to the Board of Appeals, to the District Court, and to this Court, does **not** simply involve a **composition;** for such claims 11, 17, and 18, App. 213, 214, were withdrawn as noted in the Board's decision, App. 215, first paragraph. It is **only the process claims** 3, 4, 5, 8, 16, 21 and 22 which were declared on in the Complaint, App. 3. These process claims have a special status under R. S. 4886, 35 U. S. C. 31, as an "art," as distinguished from a "machine," a "manufacture" or a "composition of matter."

In Corning v. Burden, 15 How. (56 U. S.) 252,* the Supreme Court says, pages 267-8:

> "A process eo nomine, is not made the subject of a patent in our act of Congress. It is included under the general term 'useful art.' * * *
>
> "A new process is usually the result of discovery; * * *

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* Cited and applied in Kelly v. Coe, 69 App. D. C. 202, 97 F. (2d) 435. 441, footnote.

"A process is a mode, method, or operation, whereby a result or effect is produced. Corning v. Burden, 15 How. 252, 14 L. Ed. 683. 'A patentable process is a method of treatment of certain materials to produce a particular result or product.' Holland Furniture Co. v. Perkins Glue Co., 277 U. S. 245, 255, 48 S. Ct. 474, 478, 72 L. Ed. 868."

> "It is for the discovery or invention of some practicable method or means of producing a beneficial result or effect, that a patent is granted, and not for the result or effect itself. It is when the term process is used to represent the **means or method of producing a result** that it is patentable. * * *"

In Cochrane v. Deener, 94 U. S. 780, the Supreme Court lays down the following fundamental aspect of an art or process, p. 788:

> "A process is **a mode of treatment** of certain materials **to produce a given result.** It is an act, or a series of acts, performed upon the subject-matter to be transformed and reduced to a different state or thing. * * * The process requires that certain things should be done with certain substances, and in a certain order; but the tools to be used in doing this may be of secondary consequence."

In Carnegie Steel Company v. Cambria Iron Company, 185 U. S. 403, the Supreme Court says, p. 441:

> "This proposition that the application of this patent depends upon the individual intent of the operator overlooks the essential nature of a process patent. The directions and specifications of such a patent are addressed to those engaged and skilled in the art. It professes to disclose **a method of procedure**, not the particular instrumentality that may be employed."

The principles of those three decisions have been continuously applied by the Supreme Court, by our federal courts generally, and by this Court, as shown by the cases cited in Appellant's briefs.

As noted above, we do not rely upon the fact that the properties of the drilling fluids of Stern and of Cannon were unknown, nor even on the fact that Applicant discovered "the result or effect itself" (Corning v. Burden). What we submit is that Applicant's discovery or invention is for a **method or means of producing a result**, namely, **a new method of procedure** involving the **definite procedural steps** set forth in the claims, even in the broadest claim 3, previously quoted, and involving factors (1), (2), and (3) previously noted. Such a procedure is patentable as an art or process because it has not been disclosed by either Stern or Cannon.

We therefore respectfully submit that this Court is warranted after consideration of this petition to adjudicate that the claims in suit are patentable and that the District Court should be reversed.

This petition is presented in good faith, and not for delay.

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